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The Autumn Campaign Begun.

THE autumn campaign organised by E.D.A. and E.L.M.A. was launched on Friday last at a luncheon held at the Hotel Cecil, under the presidency of Sir Philip Nash, who, on behalf of every branch of the British electrical industry, welcomed a large company of representatives of the newspaper and technical Press, who had attended to hear a description of the scheme.

The details of the campaign have been laid before our readers already, but it is recognised that the co-operation of the whole of the Press is essential to its success. The technical Press has done its best to stress the necessity for enthusiastic backing to be given by everybody electrical, and it may be relied upon to keep the subject well to the fore for some months to come; but the daily Press through the medium of millions of advertisement notices, and we trust enlightened editorial references, will reach a vast number of the general public for whom persistent electrical education is the need of the hour. The scheme has been planned along lines which, given the amplest publicity, should stimulate interest in hundreds of thousands of minds leading the at-present non-electrical public to avail themselves of the educational facilities that the "Wiring the Homes of Britain" competition provides.

Messrs. Beauchamp and Bush and their assistants have put a colossal amount of work into the organisation and elaboration of the scheme and into the preparation of the necessary publicity and advertising literature; it will not be their fault if six months hence the mentality of the population of the United Kingdom has failed to undergo an important change conducing to a more rapid rate of domestic electrical development. We profoundly hope that nowhere will there be on the part of electricity suppliers and traders a failure to rise to the occasion; it will be deplorable if the would-be consumer continues to be confronted with obduracy from any electrical quarter. We have not been free from criticism

in this respect in the past, and Sir Ernest Benn, on Friday last, quoted one of many such experiences which have been related to us, of owners of new houses who have been besieged by the baker and the milkman in pursuit of their custom, but who have to go down on their knees to secure electrical service. We hope to hear less of this sort of thing henceforth, though, of course, we recognise the difficulties of giving supply in certain special cases as matters stand at present.

To Mr. Llewellyn B. Atkinson fell the responsibility—and shall we say the honour?—of outlining the scheme. His speech was admirable in every way—indeed, the whole of the proceedings were conducted in a commendably businesslike manner, due recognition being given to the fact that newspaper men have many engagements to fill, and are sometimes likely to leave if speeches are unduly prolonged. Over-speaking frequently leads to under-reporting or mis-reporting.

Mr. Atkinson, after a fitting allusion to the work of pioneers 46 years ago when London and England first saw the electric light, spoke of our pride in achievements of the past, but, what is more to the moment, of our hopefulness in regard to the future that lies before the electrical industry, especially as a result of the present joint effort of that industry to bring the benefits of electricity into the homes of Britain. The movement is, of course, designed primarily to create new business for the electrical industry, but it is pleasing to know that in aiming at that objective we shall be bringing about a profound change for the better in the lives, and in the methods of living, of the people, including the manual operative classes. In mentioning this last point, Mr. Atkinson remarked that electricity had accomplished much in brightening the lives of the working people *outside* the home, but electricity could also be employed to engender a more contented frame of mind by improving matters *inside* the home. Bad lighting, dirty, laborious, irksome and unhealthy conditions can be obviated by the use of electricity. Electric cooking is making headway as we all know, but Mr. Atkinson was able to afford the general Press interesting information by telling them that 1,000 British-made electric cookers are being put into service weekly, and even miners, who have their allotment of free coal, are in places showing a preference for the electric cooker over the coal fire. The freedom from dirt that electrical methods afford to the modern householder is one of the greatest selling points of electricity. But, as Dr. Ferranti has so often pointed out, and Mr. Atkinson and most of us hold, the full advantage of the boon to the general consumer can only be obtained as the use of electricity becomes universal.

The educational propaganda movement of which Friday last was the official birthday, is designed to help in that direction. Mr. J. Y. Fletcher emphasised the fact that as the scheme progressed it would create business for everybody, and Mr. Atkinson claimed on behalf of the organisers the individual and personal help of every man engaged in the electrical industry.

We desire to emphasise that appeal. If well supported the scheme is bound to succeed.

A Record Radio Exhibition.

The exhibition of radio apparatus at Olympia, which closed last Saturday, broke all British records in respect of the number of exhibitors, the attendance of visitors, and the business done. The policy which we advocated last year, and which the N.A.R.M.A.T. adopted, of holding one comprehensive exhibition open to all British manufacturers, was amply vindicated; inquiries that we made at stand after stand elicited a unanimous verdict in its favour, and the satisfaction generally expressed by the representatives of exhibitors with regard to the number of callers at their stands, the orders actually placed, and the prospects of further business maturing after the close of the show, including a valuable proportion of export trade, was extremely gratifying.

The view was expressed that the Radio Exhibition had now taken its place amongst the notable trade shows of the year, and that Olympia was a much more suitable building for the purpose than the Albert Hall or the White City. It is regrettable that the train service between Earl's Court and Olympia is so meagre that it is better to walk the distance than to wait for a train, but fortunately there are other means of access, and perhaps in future years, when shortage of coal is a thing of the past, the company concerned will adopt a more enterprising policy.

The success of the Radio Exhibition will go far to raise the well-merited prestige of British products and to stimulate export trade; and if fears were entertained that the industry had seen its best days and must be prepared to face dull times, we feel sure that no visitor to the Exhibition retained that impression. Incidentally, by far the most popular item in the show was the B.B.C. Studio, which when in use always had its lengthy queue of sightseers; that was but just, for to the B.B.C. are due in great measure the Exhibition itself, and the position of British broadcasting in the front rank. The reproduction of Signal Island and the apparatus with which the first Marconi transatlantic signals were received, 25 years ago next December, was also a particularly appropriate and interesting exhibit.

Electric Cooking at Woolwich.

The reports recently published that tenants on the Eltham housing estate of the Woolwich Borough Council were up in arms against the compulsory use of electric cookers led us to make inquiries and ascertain the facts, from which we gather that the "cooking," in a figurative sense, has been done by the gas interests. The history of the undertaking is given elsewhere in this issue; it will be seen that the gas company had the opportunity in the first instance of supplying gas for cooking, but peevishly rejected the offer because the houses were not also lighted with gas. Now the gas company is alleged to be fomenting unrest amongst the tenants, some of whom complain that cooking by electricity is too expensive for their pockets, and that they must have freedom of choice between gas and electricity.

We may point out that when the tenants entered into occupation they knew that the houses were fitted with electric lighting and cooking apparatus; they could then have exercised their freedom of choice—but they accepted the situation, just as countless tenants who prefer electricity rent houses fitted only for gas. Moreover—a fact which is not mentioned in the anti-electric propaganda—every house is provided with an efficient coal-fired cooking range and boiler, as well as with a coal-fired wash-boiler, so that the use of the electric cooker is not compulsory. Some of the figures quoted for the cost of electricity—such as 3½d. for boiling a kettle of water—are too ridiculous to call for notice. It is true that the price charged by the Council is a flat rate for all domestic purposes of 2d. per kWh; consequently those who use electricity for lighting only are decidedly undercharged, whilst those who use most of their supply for heating and cooking are paying too much—but that is because the use of prepayment meters in these artisans' dwellings was essential. The Council has, in fact, recognised that a more equitable tariff is desirable, and its introduction only awaits the settlement of the coal dispute; we believe it is intended to make use of a two-part-tariff prepayment meter, an innovation which will be observed with interest. Possibly it will operate on the plan outlined by Mr. S. H. Penning in the article which we published in our issue of March 12th, 1926. If the effective price per kWh under the new tariff works out at less than 1d. per kWh for cooking, as seems likely, the Woolwich tenants will certainly have no ground for complaint.

Electrical Developments in Sweden.

Water Power Encourages Rural and Railway Electrification.

By our Special Correspondent.

SWEDEN'S water power has rendered possible the utilisation of great natural resources, and what is of the utmost consequence is that the material development of the country can proceed without a proportional increase in the import of coal. It is this fact which gives to water power such great significance in the continued independent development of Sweden. The total amount of water power available is estimated at 4½ to 6½ million turbine horse-power. Another method

Fig. 1.—Electric Wood Saw, showing pile cut by machine; the small pile represents what could have been cut by hand in the same time.

of calculation employed by a Royal Commission three years ago gives the available energy as 32,500 millions of kilowatt-hours per year.

The oldest Swedish transmission systems for general power supply are those of the South Swedish Power Co. and the State plant at Trollhättan, both of which are operated at 50 kV; higher voltages have been employed for later development. The frequency is now standardised at 50 cycles, though some power plants operate at 25 cycles. The total energy production is estimated at 3,300 million kWh per annum.

Rural electrification is well organised. During the war intensive work was commenced for the exploitation of Sweden's water power, including its distribution in the form of electrical energy throughout the countryside; more than 1½ million hectares of arable land are now electrified, representing 40 per cent. of the total arable land. The system in use in uniformly settled districts, particularly in open farming country, is known as the "three-pressure system," because three separate pressures are employed; a fairly high distribution voltage, usually 20 kV, for the rural power lines, a lower intermediate voltage, usually 3 or 1.5 kV, for the local distribution systems, and a consumers' voltage, usually 220 volts. The local distribution networks generally supply consumers within a radius of 3 to 8 kilometres from a 20/3-kV transforming point.

From the three large State power plants in Central Sweden—Trollhättan, Alvkarleby, and Motala—an area of about 550,000 hectares (1,350,000 acres) of arable land is supplied with electric power. These stations have, in rural districts, adopted the three-pressure system where, in the majority of cases, voltages of 20,000/3,000/220 volts have been employed. Usually small transformer houses are built for 20,000/3,000 volts, but pole-bracket transformer stations are often used for 3,000/220 volts. Of about 2,400 hydro-electric power stations now in operation in Sweden, about 1,678, or 70 per cent., are entirely or principally supplying electrical power to the countryside, with a total installed generator power of not more than 67,000 kVA, representing only 5 per cent. of the total rating of the electric power stations in Sweden, which amounts to about 1,286,000 kVA. The direct-current stations number 993, but the total power installed is only 11,648 kVA, as against 53,589 kVA in 637 a.c. stations.

Co-operative Rural Distribution.

The system of organisation adopted for an electrified rural district is of interest. Co-operative distributing societies are formed by individual rural consumers, and these societies are usually customers of the power supplier, while they are distributors to the stockholder-consumer. Each society raises the capital necessary for the distribution circuit of its district either by loan or by rating the members, and it usually attends to the construction of the necessary supply system for the district. It is endeavoured to give each distributing society a definite area, all the areas adjoining, so that no part of the countryside is left outside the system.

The most important application of electricity in the countryside is its use for the driving of motors, the arrangements with regard to which differ considerably in various parts of the country. With the intensive agriculture in Skåne, a 25- to 30-h.p. motor is used for driving the threshing mill, a winnowing machine, straw transporters, and similar auxiliary machinery. In Central Sweden threshing motors of 12 to 15 h.p. are common. The threshing motors, which are also used for operating stone-crushers and sometimes a saw-mill, work for only a short period every year, and as there is a tendency for all farms to do their threshing about the same season of the year, the maximum power demand from these motors might become inconvenient if no special measures were adopted to distribute their

Fig. 2.—Stockholm—Gothenburg Electric Passenger Train.

load over a longer period of time. Therefore, electric threshing is often so arranged that the same motor is used on a number of adjacent farms, which then form a "threshing union"; this has the further advantage of reducing the motor outlay for individual farms.

Each larger threshing motor is mounted on a specially-constructed van, which also carries starting rheostats and other operating gear. In many cases the motor is built for 1,500 volts, and is connected directly

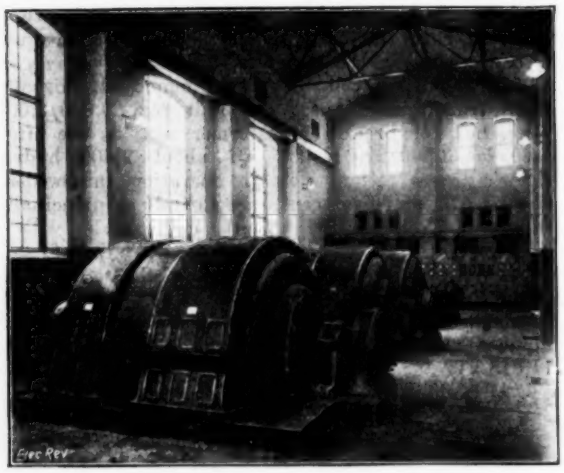

Fig. 3.—Alingsas Converter Station.

to the high-pressure line; where the intermediate pressure is 3,000 volts, a low-pressure motor is used, and a transformer is installed on the wagon.

Motors from ½ to 5 h.p. are the property of the farm on which they are used, and are placed in outbuildings near the machines to be driven by them. However, the total cost may be reduced by mounting these motors on carriages or stretchers, so that the same motor may be used alternately in a number of places on the farm.

The installation of electric lamps, motors, and other electrical apparatus employed on farms at present amounts to about 260,000 kW; the annual energy consumption amounts to about 120,000,000 kWh. It has been estimated that, after complete electrification, the country would, at the present rate of utilisation of electrical power, require about 390,000,000 kWh per annum for rural purposes.

An extension of the use of motor power for indoor work is regarded as a certainty, as electrified farms have not yet adopted the electric drive for all machines to which it could be advantageously applied. Experiments now being made give promise that ploughing can be carried on independent of animal power or internal-combustion engines. Mr. N. Forssblad, of Västeras, has constructed an electric plough to which current is supplied through an insulated cable paid out or coiled up according to the movements of the plough. Electric power might further be used for irrigation, for draining peat marshes, and for similar operations. Recently attention has been devoted to the electrical preservation of fodder in silos and to the drying of seed.

The total capital invested in rural electrification is estimated at 400,000,000 kronor, comprising 270,000,000 kronor for power stations and lines and 130,000,000 kronor for private installations on farms. The average annual cost for power and distribution amounts to about 15.60 kronor per hectare (0.4 acre) of arable land; this figure does not include the cost of the consumers' installations. The power rates charged by the larger power systems average 12 to 13 öre per kWh at the point of bulk delivery at 1,500 or 3,000 volts.

Railway Electrification.

The Iron Ore Railway, built in 1915, from Luleå on the Gulf of Bothnia to the Norwegian frontier, with its extension to Narvik in Norway, is 476 kilometres in length, which makes it the longest electric railway in Europe, whilst it is the farthest north in the world.

Single-phase current of 15 cycles frequency and 16,000 volts pressure is used for the contact lines. Power is generated at 4,000 volts, 15 cycles, boosted up to 80,000 volts for feeding the two transmission lines, having a total length of 505 kilometres and supplying fifteen transformer stations about 35 kilometres apart. At each are two or three transformers for reducing the voltage from 80,000 to 16,000 volts.

The high-pressure transmission lines consist of double conductors and are carried on three- or four-leg iron towers from 17 to 22 metres high. Four wires are required for the two conductors. The maximum sag is 10 metres, and the average span 200 metres, with a maximum of 380 metres. The contact conductor over the railway track is of the plain suspension-wire type. The conductor is attached to the suspension wire at the point where the latter is supported, and at from two to five points between. The total span on straight, clear stretches of line is 52.5 metres. The conductor wire is made in separate sections of 1.4 km. length, kept taut by means of a weight at each end.

The rolling stock consists of four express locomotives,

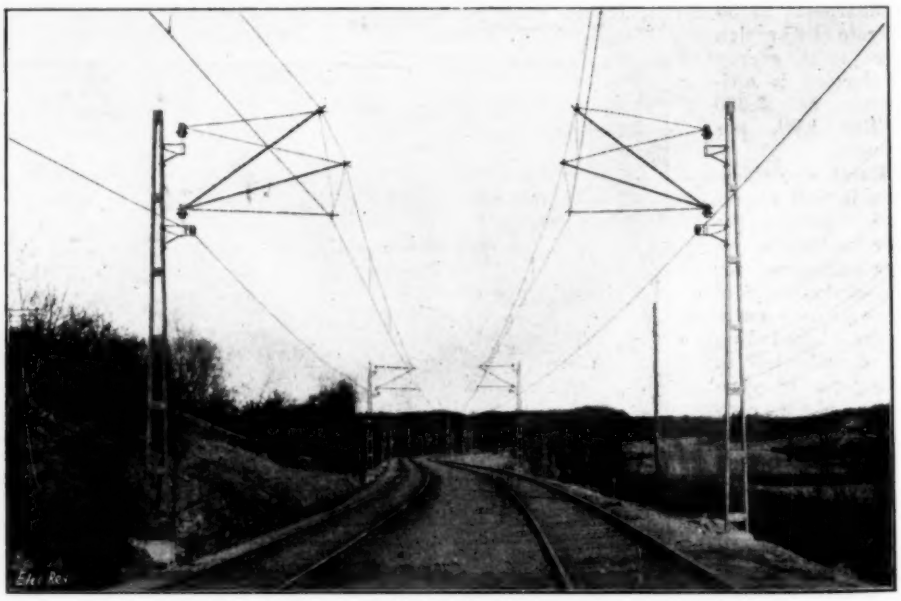

Fig. 4.—Double-track Line on Stockholm-Gothenburg Railway.

one passenger locomotive, 33 ore-train locomotives, 12 goods and shunting locomotives, and two motor-cars. Ore trains are composed generally of 40 trucks, conductor's van and ore-locomotive, weighing in all 2,000 tons. The speed attained by these trains on the steepest gradients (10 per cent.) is 30 to 35 kilometres per hour.

Two insulators, each supporting a 6-mm. steel wire, are fitted at the top of the contact-line poles. This wire is used to conduct 60-cycle, single-phase current of

10,000 volts pressure to all the stations and certain other places along the railway. The current is transformed down at those places to 2 × 110 volts by 3-kW transformers hung on the contact-line poles. Residents in the vicinity of the railway are in this way supplied with electric light and power.

Electrification has made it possible to increase the weight of trains about 40 per cent., and to reduce the time by half, thus increasing the capacity of the line for ore transport nearly three times.

Stockholm-Gothenburg Electric Railway.

The experience gained in the north of Sweden encouraged the movement for electrification in the south. In 1920 Parliament sanctioned the electrification of the Stockholm-Gothenburg main line, 458 kilometres in length. Three years later the work was put in hand, but it was not until 1924 that a beginning was made with the erection of poles, the laying of cables, and the building of converter stations. The first of these stations was completed and put into operation on July 1st, 1925, when a train was run between Moholm and Skövde (30 km.). On May 15th this year the first electrically-driven train left Stockholm at 12.40 p.m. and arrived on schedule time in Gothenburg at 9.15 p.m.

The successful accomplishment of this important work of railway electrification was not unattended with difficulties. One problem—that of interference with existing telegraph and telephone lines—was solved by placing the latter underground, thus permitting the use of single-phase current for the operation of the railway, converted from the national three-phase system, which has been extended at the principal power stations—Alvkarleby, Västeras, Motala, and Trollhättan. Main lines interconnect these stations, thus enabling power to be taken from one or the other as required for the railway supply and ensuring continuity of supply even if there is a temporary breakdown in any station.

Sub-stations have been erected at Södertälje, Sköldinge, Hallsberg, Moholm, and Alingsås, where the three-phase supply is transformed by means of rotary machines to the low-frequency single-phase 16,000-volt supply required. The distance between the converter stations is 125 km.

The trolley line construction (fig. 4) is of the Z type, the wires being arranged on iron tube supports, which can be turned, and are equipped with an automatic device for regulating the tension, so that it can be kept constant. The trolley circuit is divided into 12 independent main sections, in addition to minor sections, which are fed directly from the converter stations.

The Alingsas converter station (fig. 3) contains three motor-generators, each consisting of 6,300-V, 50-cycle synchronous three-phase motor driving a synchronous single-phase generator, which delivers current at 3,000 volts, $16\frac{2}{3}$ cycles per second. Each motor-generator set can deliver continuously 2,400 kVA, and will stand an overload, for short periods, up to 4,800 kVA. The motor and the generator are both mounted on one shaft with two bearings, one at each end of the set. On the extreme ends of the shaft are mounted the two exciters for supplying the required magnetising currents. On the right of the switchboard are housed the single-phase transformers which raise the voltage from the generators up to 16,000 V, whilst behind the switchboard are placed the circuit-breakers for the outgoing single-phase feeder lines.

All the control gear is semi-automatic, and is operated from the switchboard by means of one control-handle for each motor generator. The control of the circuit breakers in the outgoing lines is also centralised at the switchboard. The circuit breakers are so arranged that when a short-circuit occurs in the trolley circuit, they automatically break and then again close

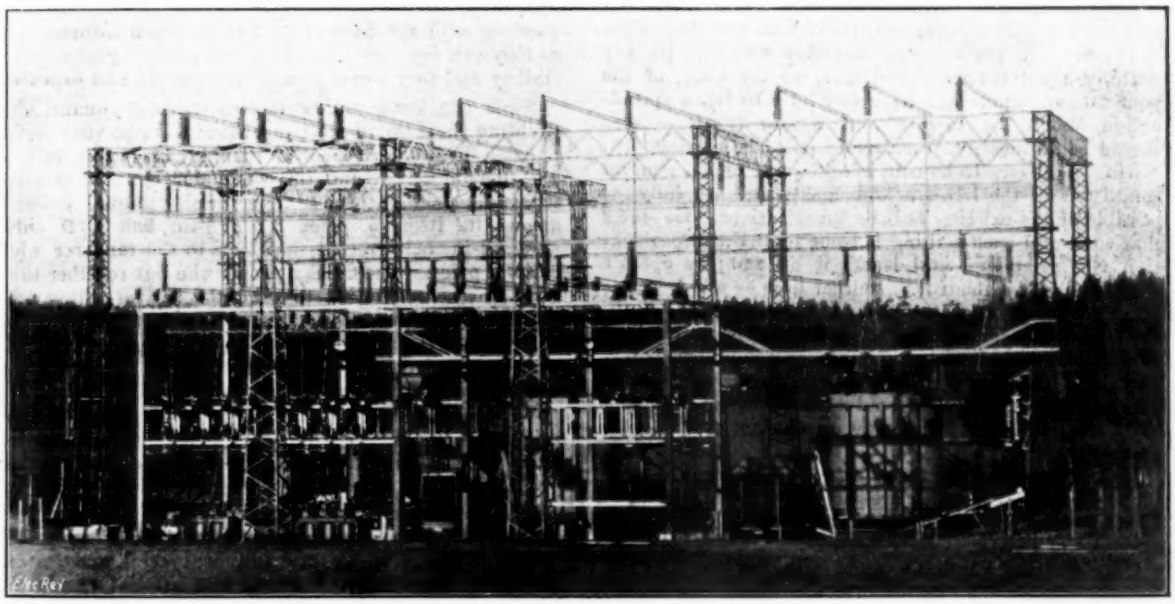

Fig. 5.—Outdoor Transformer Station at Alingsas.

the circuit after 30 seconds' interval, and if this is unsuccessful, the operation is repeated after a lapse of three minutes. If the latter fails, the station staff is warned by an alarm signal that a permanent line short-circuit needs investigation. The station is laid out on one floor, except that under the machine room is a basement through which the cooling air required for the motor generators and transformers is led.

Each locomotive has a total weight of 79.5 tons, of which 51 tons falls on the driving axles, and carries two motors, aggregating 1,700 h.p.; the weight of the locomotive is 46.8 kg. per h.p., compared with 100-150 kg. per h.p. for steam locomotives. When used for express passenger train service, the locomotives draw trains up to 500 tons at 90 km. per hour; for freight trains representing a load of 900 tons, they speed up to 70 km. per hour. A passenger train is illustrated in fig. 2.

The driving power is gear-transmitted to a jack-shaft mounted in the frame on a level with the driving axles. From the jack-shaft power is transmitted to the driving axles by means of coupling rods. By interchanging the gears between the motors and the jack-shaft, an express locomotive can be converted into a freight locomotive (or *vice versa*) within two days. The machine compartment is in the middle of the locomotive where, in addition to the motors, is installed the transformer to convert the 16,000-volt supply to voltages from 24 to 1,000 V, which are used for regulating the speed of the

motors and for supplying current for auxiliary motors, lighting, and heating. Power from the converter station is brought through the trolley wire to pantographs on the locomotive and through a lead-in insulator to the main switch in the machine compartment, thence to the transformer, and returns *via* the frame of the locomotive, the wheels, the track, and the return conductor, to the converter station. The main switch opens and closes the circuit and, on overloads or short-circuits in the locomotive, it automatically breaks the circuit. It opens for an overload and minor faults, but on heavy short-circuits leaves it to the circuit-breaker in the converter station to function.

Each locomotive is fitted with a "dead-man's handle"; the train staff can operate the emergency brake, which also breaks the current in the motors, while the line staff can do the same by switching off or short-circuiting the trolley current. In the latter case the train can be stopped by means of special apparatus located in the locomotive, which starts the emergency brake as soon as the trolley wire is de-energised.

The total cost of the Stockholm-Gothenburg electrification is, in round figures, 40,000,000 kroner, which represents a cost of 87.300 kroner per km. of electrified road. The cost is made up as follows:—Converter stations, 4½ million; trolley wires, &c., 15½ million; cables and removal of telegraph and telephone lines, 11 million; electric locomotives, 11 million kroner.

Engineering Specifications and their Writers.

By One who has Suffered from them.

THE miserable and unfortunate worm writing these notes has had a long and mostly painful experience of the documents and persons mentioned above. He has met various sorts: good, bad, indifferent and damnable.

If only for the sake of material economy (to say nothing about the wear and tear, or the time, of the poor human beings who have to tender to it), a specification should be *concise* and *clearly worded*—there should be no inessential matter in it. The sensible consulting engineer, if he can, specifies the model general conditions of the I.E.E., and makes use as fully as possible of the existing B.E.S. Specifications. He states that such and such a thing is to be to B.E.S. Specification No. so-and-so, and leaves it at that; he doesn't write a lot more about it. Neither does he ask for a lot of unnecessary information and tabular matter from the tenderer. His schedule of quantities is cut as short as possible, each item being made as comprehensive as may be. There is a provisional sum to cover contingencies and oddments instead of a thousand and one extra schedule items which may or may not ever be used on the job.

It is a rare pleasure (rare in a double sense) to meet such specifications, which are short and sweet and sufficient to satisfy all parties concerned. They are usually examples of terse and clear English.

On the other hand, we often get the specification verbose, usually the product of a gentleman who thinks it necessary to write a lot of words in order to earn his fees. These specifications are fat like Fox's "Book of Martyrs," but fuller of tommy rot and a jolly sight more wearisome to read; in fact, "full of sound and fury signifying nothing." Instead of using the Model General Conditions, these gentlemen invent a special set of their own, and instead of calling for materials to B.E.S. Specifications and leaving it at that, they have schedules printed at the end of their specification, containing specifications of materials and tests on same which may be modelled on the B.E.S. Specifications, but modified here and there apparently to show that the engineer has a mind of his own and can ask for something different to what is usual. This means that the man who has the estimate to prepare must spend time comparing the rigmarole in the specification with the B.E.S. Specifications to see where the differences lie. He has then to submit these differences to his works department to find out if they can be complied with and what extra it will cost: because his works is laid out primarily to meet the B.E.S. Specifications and the B.E.S. tests. These little fads also mean extra expense to the buyer of the goods, and often delay in delivery. Another idea of these brainy people is that, instead of using the standard figures for working conditions and factors of safety, they alter these a little in order that no standard tables can be used. The happy tenderers have individually to spend a considerable amount of unnecessary time in specially working out sizes and so forth, because their standard tables do not apply.

Other engineers are demons for tabular particulars and drawings of all sorts, shapes and sizes, mostly unnecessary, which they call upon each tenderer to supply, possibly with the idea of getting as much information as they can for nothing. This sort take no real responsibility and they cause contractors trouble and expense.

Some engineers wallow in schedules of quantities, dividing these up in most ingenious ways so that every possible item that can be thought of is put in the schedule in detail, and the contractor is asked to give separate prices. Such a schedule might include among its items a price for a ⅝-in. bolt D/D only and a ⅝-in. bolt erected, and woe to the tenderer who omits a price. The finicky people who put together this sort of schedule ought to have the job of filling the prices in: the punishment would then fit the crime. A murrain on them: two murrains. Diogenes exclaimed on the large number of things he could do without—I expect he had this sort of specification in mind.

On the other hand, there are engineers who give no schedules of quantities, but call upon the contractor to make his own and be responsible that the schedules he prepares contain everything that can possibly be wanted.

We have consulting engineers (species now rare, I am happy to say) who supply the contractor with detailed drawings which are full of special gadgets of their own invention and details that are not standard. They embody his ideas of long ago, when things were not standardised as they are now, but the same drawings keep on coming along, and the engineer is angry if the contractor takes latitude in these details or objects to supply things that he cannot produce without a lot of trouble and expense, but for which he has suitable alternatives.

Another genus of engineer that we have met occasionally is the man who somehow gets the job of consulting for some scheme, and sends round to half a dozen different contractors, asks each of them to get him out a scheme, give him full engineering details, make a tender showing in detail the cost of the work and show how sizes, &c., have been calculated. Then he makes selections from the lot and produces "a scheme of his own," to which they and others are asked to re-tender. The real name of this priceless person is only known to the contractor's estimating staffs, and cannot be given here. The writer will, however, divulge it, in confidence, to anyone who is curious.

You may think (it is just a remote possibility) from what I have said that men who write specifications are my enemies. They are really my friends: I earn my living by trying to circumvent them. We are commanded to forgive our enemies, but I don't think we are told to forgive our friends. So I have said what I have said.

I'm told there is a special heaven for good consulting engineers (with their specifications) to go to when they die; and it's not overcrowded either.

The World Power Conference.—III.

Some Impressions and Reflections.

By THEODORE RICH.

FEW scientific organisations have had so many "meaty" papers put before them for discussion as the World Power Congress had at the recent meeting at Basle, and few exhibitions have been held at which so many comparative diagrams and educational charts have been grouped together in a small space. Many of the models shown were admirable in execution, and it is rarely that so many photographs have been got together illustrative of work relating to hydraulic power production and inland navigation.

At the first World Power Conference at Wembley in 1924, there was such a number of papers presented that it was somewhat difficult to draw conclusions from the mass of material available, and therefore there was a tendency for much material to be, in a way, lost, although particulars can be found in the admirably printed proceedings published by Messrs. Percy Lund Humphries.

At Basle, five main subjects were dealt with only, three of which were very closely allied, namely, (A) Water Power and Inland Navigation; (B) the Interchange of Electricity between Countries; and (C) the Relation between Hydraulically and Thermally Produced Energy. Throughout these three subjects the dominating question was the methods by which the maximum water flow could be commercially utilised.

Questions connected with the electrification of main-line or normal-gauge railways, Section E, and with "Electricity applied to Agriculture" will be dealt with separately, although, apart from suburban traffic, the availability of water power has been a most important factor in the encouragement of the former, especially in districts where coal is dear.

Overall Efficiency.

Regarding the general equipment and layout of water-power installations in the early days, capital was content with a lower interest, and labour for machine work and building was much cheaper than to-day; there was then usually more power available than there was a demand for, and therefore the question of cutting down capital cost and increasing the overall efficiency of plant and accessories was not so important as it is to-day.

Nowadays money is dear, building work almost prohibitive, and in order to get a paying proposition, the utmost vendable load must be got out of the water available at such times and under such conditions as will command the highest price per kilowatt-hour. Unless, therefore, a station is of such a size or type that one set of machines can be run, each turbine of the set at constant load at the point of maximum efficiency, while another group is designed to take up the variations between the turbine unit steps, it is desirable that not merely should the full load efficiency of the turbines be high, but also that the efficiency curve should be comparatively flat over a large load range, so that the utmost can be got out of the available water when nothing is flowing over the weirs. In the case of low falls, a factor has been the careful design of the draught tubes. In order to keep down the cost of buildings, and to a lesser extent that of the generators, the speed of revolution must be made high. In the past, to increase the specific speed, horizontal turbines, with as many as six wheels, have been used at times to this end. There are two comparatively recent developments, the propeller turbine or the use of high efficiency spirally-cut gearing. The propeller turbine has been greatly improved owing to the initiative of Professor Kaplan, of Brün, who not merely designed screws with movable blades, but through his success also encouraged several leading makers of turbine plant to study the design of fixed-blade propeller turbines and to make improvements in the design of turbines of the Francis type. Fig. 1 shows a Kaplan turbine made in the Ravensburg shops of Messrs. Escher Wyss, shown in the machinery building at the exhibition, output 3,120 h.p., 167 r.p.m., at 8.2 metres head, for the Ladenburg station on the Neckar.

In many classes of hydraulic work there has been a tendency recently towards the use of vertical machines. With Pelton wheels, four jets can be used instead of two; with very low heads, the cost of the inlet works can often be reduced; and, further, the design of draught tubes can be improved. Now that revolution speeds are much higher, the cost of power-house generating buildings and foundations can be reduced, and for very large

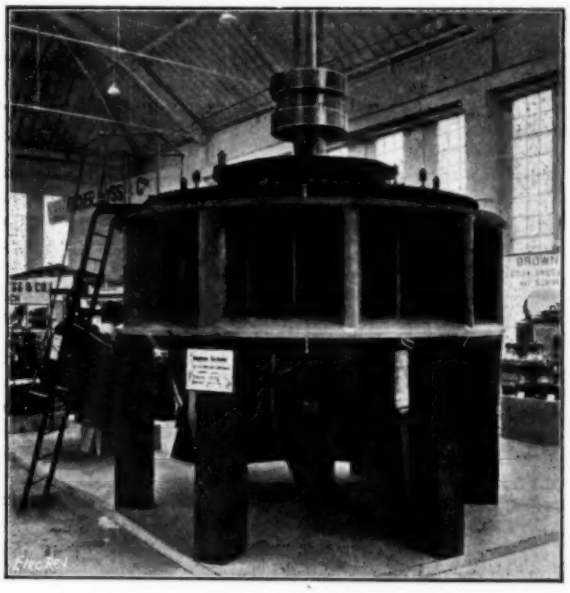

Fig. 1.—A 3,120-h.p. Kaplan Water Turbine.

closed generators where forced ventilation is used, the vertical machine is in a way more convenient for closed-circuit cooling than one of the horizontal type.

Utilisation of Surplus Water Power.

A burning problem of the day among water-power engineers is the utilisation of seasonal surplus. In some parts of Sweden, and at a place near Grenoble, it is sold for making steam for paper mills to reduce the call on coal-fired boilers; for such work, however, only very low prices per kWh can be charged in competition with coal even at its present price.

In some places, seasonal electrochemical work has been developed, the bulk of the labour taking on agricultural or other work during the driest time of the year; in some cases the chemical makers concerned are allied financially to the power generating companies. The sugar beet system on the Continent, which involves factory work for a few weeks in every year, has accustomed many men to seasonal vocations.

There is a third alternative in the storage of water by the blocking up of valleys with dams, forming reservoirs of such a capacity that the normal load can be carried for three months or more. Dams are usually very expensive to construct; it is most desirable that the gross head shall be high so that the power stored per metre cube of water can be also high, with as large an

additional fall as possible from the minimum operating reservoir level to the turbine inlets at the power house, so that if the water level is lowered during the dry season, the operating head will not be reduced by too great a percentage, or the economical working efficiency of the turbines greatly impeded.

It is only in recent years that very large dams have been constructed for the storage of water for water-power undertakings; early large dams were practically all constructed for city water supply, or for irrigation. It was only towards the end of the proceedings at Basle that the point was mentioned that, in view of the high cost of dams and the benefit the community could get through the amelioration of floods and facilities for irrigation due to the regularisation of highland water, it was only proper that in many instances a material proportion of the cost of such undertakings should be charged to such services, and that Government subsidies could be made in all fairness towards the cost of dam construction, thus relieving to a material extent the electrical enterprise as such from part of the capital charges.

It might be remembered that in Calabria, in the heel of Italy, owing to the existence of material swamps resulting from floodwater, and also to the drying up of certain lands in summer, large areas are very sparsely inhabited; whereas the construction of large dams, as for the Sila project, will enable large areas to be drained and others to be irrigated so that hundreds of peasants will be able to find employment at home instead of having to go abroad, and distant industries will be benefited.

Auxiliary Pumping Storage.

Where a high-level dam is practicable, with a material natural collecting area draining into it, then under favourable circumstances a water-pumping storage scheme may become an economic proposition, provided the extra plant, &c., required is reduced to a minimum. This means that, provided the station is linked up with other stations which have different seasonal factors, then at times when but little is flowing into the reservoir from above, surplus power can be used to pump up water to be returned later to the network as power, and such pumping can also be done at night if there is a surplus available from outside which can take the night load as well. This scheme has been adopted at Waggithal, near the Lake of Zurich, and several somewhat similar schemes have been constructed or are in progress elsewhere.

The efficiency of any pumping storage plant is not high, and arrangements of that kind can only be economically sound under exceptional circumstances; there is the point, however, that the power ultimately sold can, under some circumstances, be more favourably priced than "night power" or seasonal flood-time power.

The use, at times when a water-power station would otherwise have to be shut down, of the pressure pipes, transformers and transmission lines belonging to it, so that surplus power from outside, generated from surplus water, can be used to store up water in an existing high-level reservoir at times when the load requirements of the interconnected network allows of it, is quite a different proposition to the suggestion of our Transport Ministry some years ago that the tidal power of the Severn be used to pump water into a distant low-head reservoir, to be let out again at times of low tides.

Herr Von Muller, of Bavaria, urged that housewives should be encouraged to do their cooking by electricity in the summer time, when no general house heating was required, thus utilising the surplus water power then available. He said that a water-power installation put up without due regard to the interests of possible installations up stream and down stream was a "robber works," and that the Government of Bavaria had taken steps to prevent such troubles in the future; also that rates for cooking should be charged that a housewife could understand.

Mr. Patchell pointed out that in England in some places all-in rates were charged, based on a price dependent on the rates on the house, plus a small sum per kWh.

Apart from the central-station plant and buildings, the cost of sluices, dams, inlet works, pipelines, and many others of the items required for modern hydraulic development works, which form such a material percentage of the total capital cost, do not increase proportionately with the installed power capacity, and therefore provided there is a market for the power developed, it often pays to increase the capacity of the plant installed beyond what would appear to be reasonable at first sight. As pointed out at the Conference, a reservoir of a day's capacity can, under some conditions, enable a high-priced lighting load peak to be carried at a comparatively moderate extra capital cost. There seemed to be material differences of opinion as to whether peak loads should be taken by water or thermal plant.

The "Grid" Problem.

In those countries where the interlinking of power supplies has been greatly developed, the driving force has been the existence of water-power installations, the available gross water supply to which could only be developed in a reasonably economic manner when deficiencies due to seasonable variations or droughts could be made up from elsewhere, or where, as in lignite districts, very low grade fuel exists which will not bear transport costs. If one can judge by the papers read at the Conference and by diagrams at the exhibition, in view of the admittedly high costs of transmission, it can be said that little has been disclosed which would justify the construction of a vast grid at home with corresponding high salaried officials in a country where steam plant is the predominant factor.

Water Power and Interconnection.

From water-power districts in America and Central Europe, evidence was given that in order to take the maximum advantage of the water available and to minimise the effects of normal seasonal variations in watershed discharge, and to minimise inconvenience from abnormal droughts, interconnection with other water-power seasonal variations or with thermal power stations has ceased to be a virtue and has become a necessity. The Alpine highland districts have a summer flow from melted snow, some lowland districts a winter flow. In France, the Alps, the Central Plateau, the Pyrenees, and the St. Etienne colliery district are being linked up so that the water available can be utilised to the utmost.

The papers on the interlinking of hydraulic and thermal power supplies were very interesting, and they brought forth animated discussions. Messrs. Mitchell and Gallalee, in their paper No. 76 in Section C, pointed out that, thanks to interconnection and the aid of steam power, many power customers in Alabama and Georgia had been saved great inconvenience at times of drought, the base load being carried by hydro-electric plant and the fluctuations by steam plant in the wet season, and *vice versa* in the dry season. A committee was formed so that the maximum use could be made of the power available.

Mr. John W. Lieb, president of the New York Edison Company, who presided at the time that the above mentioned paper was being discussed, said that it was most important that when large centres were supplied with power over long transmission lines, there should be local thermal stations to supply instantly any demand due to the interruption of the transmitted supply, and considering the fire, sanitary, lift, street railway and other social services dependent on electricity, it would be simply unthinkable, if power was in the future to be transmitted from, say, Niagara to such cities as New York, Boston, or Philadelphia, for them to be without adequate local thermal reserves.

Mons. Arbelot, of France, honorary director of the Hydraulic Power and Electrical Energy Department of the French Ministry of Public Works, contributed a paper on the economic relations of water and thermic plant which went down to the economic hard tacks of power generation. He said that high-voltage networks

of 100 to 120 V involved at the present day an immense capital cost, and that such networks could only be justified when the lines could be kept well loaded; that, as compared with pre-war conditions, a much larger percentage of available water power must be sold before such undertakings became economically desirable, and that, pending the growth of such loads, local thermal stations might be constructed to develop the load until the economic limit was reached.

National Power Interchange.

Apart from questions of public policy regarding the utilisation of available water power inside a country for the development of home industries, rather than to export power, even at temporary advantage, to other countries, where it might aid the development of perhaps competing industries, a matter that is giving rise to great controversy in Canada, and which was discussed also by Herr Von Möller, of Bavaria, from the technical point of view the interchange of power between countries resembles the interchange between districts.

Switzerland to-day exports about 140 kWh of electrical energy per head per year to France, Germany, and Italy combined, and during the winter at times of low water it is even beginning to import power from France generated from coal. A scheme is now being considered for the utilisation of the winter flow of the Moselle in both French and German territory, and for the linking up of the stations through the Vosges to Switzerland so that power can go north at one time of year and south at other times.

A Special Use of C.T.S. Cables.

Their Superiority for Submarine Landing Lengths.

CABLES running out from the shore into the sea are subject to continual chafing against rocks and stones between high-water mark and low-water mark by the tides, to damage from heavy rocks that are washed about, and to the effect of weather. They are for several hours a day alternately wetted by the tide, and dried by the sun; this treatment has a rusting and rotting effect of the most severe description on metal armour and fibrous protecting materials, and it is little wonder that ordinary cables will not stand up to these destructive conditions.

Experiments have been carried out with ordinary C.T.S. cables, together with lengths of the ordinary

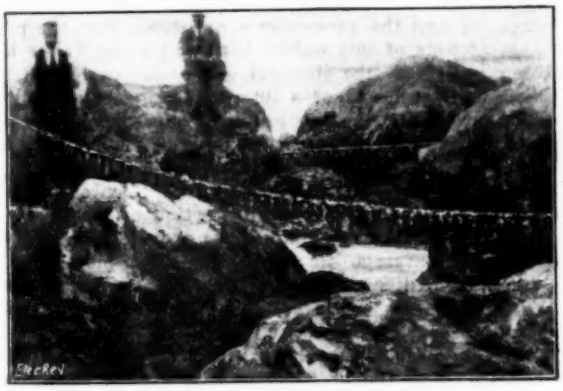

Fig. 1.—Test Cables on Rocky Coast.

metal-and-fibrous-protected cables for submarine work on Government service, which were all laid upon the rocky reefs running into the sea near Culver Cliff on the Isle of Wight, and were so arranged that they were alternately covered and exposed during the normal daily double tides. Inspections were made of these cables at intervals, and, later, samples of specially designed armoured cables were also put down, together with C.T.S. cables which had been specially designed.

The conditions of this Isle of Wight testing place were more than usually severe, but some of the cables stood up fairly well for a lengthy period, and it was thought advisable to subject them to the most stringent tests known on the British coast, namely, on the well-known Chesil Beach near Portland, and also on the rocks adjoining that beach.

The following is a summary of the results regarding the Isle of Wight cables:—

The old standard type was practically worn out after two or three years' exposure, the armouring having buckled and bird-caged, and the strands being worn or corroded through where they were chafed. The fibrous coverings had rotted and had been stripped off.

As recently as 1925, however, when the last examination was made, the ordinary-type C.T.S. cables were still in excellent condition. In some places, where they ran over the edges of rocks, slight abrasion could be discerned, but this had not penetrated the sheathing in any place.

Regarding the other cables of new design put down later, in the case of the standard cables the fibrous coverings overall were in bad condition, and there was evidence of corrosion of the wires. This was after about 18 months' exposure.

The C.T.S. cables of new design were in excellent condition. In one or two places knife cuts had been made on the surface of the C.T.S.; these appeared to be deliberate, and were possibly made out of curiosity by local visitors.

These results were confirmed by the latest reports received before the trials were discontinued.

The experiments at Portland were started in May, 1924; in September, 1924, the results were as follows:—

Cables of standard type: One had broken in half on

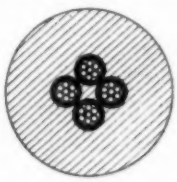

Fig. 2.—Section of the C.T.S. Cable.

the Chesil Beach. Those on the rocks were in good condition. C.T.S. cables (St. Helens) were in perfect condition. Other C.T.S. cables had slightly cracked in places.

In January, 1925, six cables laid on Chesil Beach had been washed below low-water mark in a bunch. Inspection showed that the C.T.S. cables were in good condition, but the others were defective.

Of six cables laid on rocks, the C.T.S. (St. Helens) was in good condition. The standard cables of revised design had their braiding affected in places and the armour rusted.

We are indebted for these particulars to the St. Helens Cable & Rubber Co., Ltd., which has received the permission of the Government Department concerned to publish them; the results are held to prove the superiority of the C.T.S. type cable, as compared with other armoured types, for landing lengths of submarine cables for purposes other than telegraphy.

Old Ellesmerians Memorial Chapel.—The ceremony of laying the foundation stone of the chapel of Ellesmere College, Shropshire, which is being erected as a memorial to old Ellesmerians, will take place on Thursday, September 29th, and not September 30th, as announced in our last issue.

Vents Applied to "Flame-Proof" Motors.

The Limitations of "Flange Protection" and Some Alternatives.

By PERCY HUGGINS, A.M.I.E.E., Assoc.A.I.E.E.

"FLANGE protection" has become the accepted nomenclature to apply to mining apparatus having flame-proof enclosure, and covers any arrangement whereby the joints formed by the covers are not made gastight, so that they afford a means of releasing the excess internal gas which tends to accumulate when a difference of pressure is set up between the inside and outside of the case principally by (*a*) the normal temperature changes of the apparatus, and (*b*) internal gas explosions.

To this end the joint flanges are often left rough machined, or, alternatively, they may be definitely separated a small fraction of an inch by thin distance washers, or other means; and the joint flanges are proportioned of such depth that the fiery gases which will escape under the pressure of an internal explosion will be cooled in passing between them to a temperature below that capable of causing the ignition of any explosive gas with which the apparatus may be surrounded.

In many collieries where electric power is utilised there are situations which are extremely wet, or in which the atmosphere is clouded with fine dust, and under such conditions electrical apparatus provided with flange protection does not give satisfactory service owing to the percolation through the joints of matter which is most deleterious to motor windings and electrical gear generally. (These remarks are most appropriate to machinery operating at the coal face, such as motors which form components of electric coal-cutters, or face conveyors.) For such plant a more reliable construction incorporates watertight jointing material at all joints formed by the covers and the components of the enclosing case. When joints are sealed in this manner, for reasons which are analysed below, it becomes very important to provide a suitable air passage communicating between the inside of the case and the surrounding atmosphere.

Effects of Normal Temperature Changes.

The temperature of an electric motor fluctuates more or less regularly. When at rest its temperature becomes equal to that of its surroundings; if operated for a period on full load it attains its normal temperature rise, while its load variations or intermissions are accompanied by temperature changes. Every such temperature change causes thermodynamic changes in the gas within the enclosing case in accordance with the laws of Charles and Boyle, from which it is deduced that one of the following changes in the gas within the motor must result:—

When A = atmospheric pressure (14.7 lb. per sq. in.);
A_1 = pressure (lb. per sq. in.) of gas in motor case before heat change;
T_1 = absolute temperature deg. F. of motor before heat change;
T_2 = absolute temperature deg. F. of motor after heat change, and
v = volume (cubic feet) of gas space in motor.

In case 1, if there is no leakage of gas from the motor case (*i.e.*, with constant volume) there will be a change of gas pressure within the enclosing case equal to $(A_1 \times T_2/T_1) - A_1$.

In case 2, if there is a leakage of gas through the enclosing case (*i.e.*, with constant pressure) there will be a passage of gas from the inside of the motor case to the outside, or *vice versa*, equal to $(v \times T_2/T_1) - v$.

Hence, during the normal heating of a motor, when the temperature rise may be taken as 90 deg. F. on an ambient temperature of 60 deg. F. (*i.e.*, with a change of temperature of from 521 deg. F. absolute to 611 deg. F. absolute*) there is produced either:—

(1) An increase of internal gas pressure of $(14.7 \times 611/521) - 14.7 = 2.54$ lb. per sq. in. (assuming normal atmospheric pressure in case to start with), or (2) a leakage of gas from the motor case of $(v \times 611/521) - v = 0.173\ v$, or 17.3 per cent. of the air initially in the motor. (The gas space in several typical coal-cutter and conveyor motors variously rated between the limits of 8 and 40 b.h.p. were ascertained to be from 1 to 4 cu. ft., and hence as much as 0.173 to 0.7 cu. ft. of gas would be forced out and sucked in through the motor case due to the heat changes produced by normal shift working.)

The thermodynamic actions consequent on temperature changes which actually occur in the gas in motors not provided with ventilating, or breathing, means have been investigated, and as a result it is generally recognised now that the once much used expression "gas-tight" is a misnomer, and should never be applied to mining motors—they are "flame-proof" merely. Only in laboratories have motors been specially assembled so that gas-tightness has been secured for a lengthy temperature run, and in such cases temperature changes have produced changes in the internal gas pressure in accordance with the formula given above for Case 2. Tests conducted on motors under normal working conditions reveal little, or no, change in the internal gas pressure, because almost invariably leakage at the bearings, &c., soon equalises the internal gas pressure and the atmospheric pressure. For the purpose of tests of this nature with which the writer has been identified, the internal gas pressures have been measured by means of a Bourdon gauge calibrated to 5 lb. per sq. in. plus and minus of atmospheric pressure and screwed into the inspection cover of the motor under test.

Such experiments and practical experience convince one that the normal breathing action of motors is of the utmost importance, and, if not provided for, greatly reduces the average life of the windings of motors working under difficult conditions. Damage is caused mainly during cooling. Non-vented motors, which have satisfactorily withstood partial immersion in water tests when they have been cold from the commencement of the tests, have been flooded when they have been similarly immersed while hot and allowed to cool while standing in the water. Also, in the case of those types of electrically-driven coal-cutters having pump lubrication in, and oil reservoirs formed by, the gear cases into which the motor shaft extends, several pints of oil may be found in the motor if the drainage of oil from the motor case, or (where provided) the overflow chambers of oil-excluding bearings, is inadvertently missed for a few days.

Further, it has been observed that the provision of a suitable vent induces a valuable self-drying effect in the motor in virtue of the heat which it develops during normal working. The ingress of a small quantity of water, in excess of the natural humidity of the atmosphere, into a non-vented motor provided with jointing material is remarkably disastrous. The water will remain in the motor and alternately vaporise when the motor is hot and condense on all internal surfaces during cooling. The continual repetition of this action seems to render impotent the best waterproof impregnating and finishing varnishes, and impairs the insulation values of the windings to the breakdown point. Timely introduction of a degree of correct ventilation in such cases has resulted in the self-drying of

*Absolute temperature deg. F. = temperature by ordinary Fahrenheit scale + 461.

motors and the preservation of their windings. Of course, apart from experimental work, if a motor once gets thoroughly damp, its windings should be properly dried by other means before it is run again at normal voltage.

Effects of Internal Gas Explosions.

The possible effects of gas explosions within "explosion-proof" motors have to be studied at all stages in the production of such machines, particularly with regard to the release of explosive pressures and the prevention of the spread of the explosion to any inflammable gas with which the motors may be surrounded. Any such internal explosion will be accompanied by a higher pressure rise within the motor case if the joints formed by the covers and the components of the frame are substantially sealed with jointing materials, and there is no vent.

It is known that a simple explosion in a gas-tight case of a most explosive mixture of methane and air (CH_4=9.5 to 10.5 per cent.) in any quantity ordinarily found in mining motors, produces the maximum pressure of about 103 lb. per sq. in. when the case is spherical and ignition is started exactly in the centre of the sphere. When the point of first ignition is asymetrical, or the enclosing case is not spherical and has internal fittings, the course and effects of an explosion become complex. This is because flame, owing to the fact that it spreads from the point of first ignition at a fairly even rate (4 to 7 ft. per second with typical mixtures) in all directions in which there is inflammable gas, will reach earliest those solid surfaces which are nearest to the point of first ignition, and will complete combustion in those parts, and become substantially cooled, while the remainder of the flame is proceeding to envelop those parts which are further from the point of first ignition. The effect of contact between inflamed gases and cool solid surfaces is to considerably reduce explosive pressures; and asymetry of the point of first ignition has a like effect in a simple chamber, owing to the flame reaching its limits in different directions at different times, and thus a portion undergoing combustion is afforded a greater measure of pressure relief by those portions where combustion has either been completed or has not commenced.

On the other hand, another complexity, known as "pressure heaping," may be introduced by departure from the conditions defined for the simple explosion, and this produces an effect which is opposite to, and may considerably outweigh, the pressure-reducing influence primarily associated with asymetry of ignition and the greater area of solid surface which necessarily is presented by departure from sphericity of the explosion chamber. Pressure heaping occurs when the enclosing case is so tortuous that sections are formed that are interconnected only by ways which are relatively small, but yet large enough to propagate flame. In such circumstances an explosion in one section will compress the gas in an adjacent section before the latter is ignited. As a consequence of the higher initial pressure in the adjacent chamber, the explosion there will be more violent and, owing to the smallness of the interconnecting path, insufficient gas will flow to relieve the second chamber from an explosion pressure somewhat in excess of the maximum obtainable with a simple explosion. If several sections are involved consecutively in this manner, pressure heaping is cumulative, and may terminate in a pressure of some hundreds of lb. per sq. in. in the section lastly ignited.

In the design of "explosion-proof" motors arrangements which conduce to appreciable pressure heaping are avoided, and when this precaution is taken the net result of all the complexities introduced by the fittings and irregular gas space within a motor is a substantial limitation of explosion pressures. All results of actual explosion tests on motors so designed which the writer has witnessed at Sheffield University, or about which he has received authentic reports, prove the explosion pressures to be from 5 to 30 lb. per sq. in. in the case of motors with flange protection, as compared with 20 to 50 lb. per sq. in. in cases in which water-tight jointing has been fitted and there has been no provision for pressure release. The provision of vents on motors of the latter type effects a degree of pressure release somewhat similar to that afforded by flange protection, and affords a most assuring factor of safety for any motor case of rational design which has satisfactorily withstood the common hydraulic-pressure test of about 100 lb. per sq. in. The intensity of the source of ignition and turbulence of the gas, while being factors which reflect slightly in the time-pressure characteristic of an explosion, do not affect the maximum pressure more than about 5 per cent.

The gross calorific value of methane is 1,010 B.th.u. per cu. ft. at 60 deg. F. and 30 in. mercury, which means that the gross calorific value of the most explosive mixture of methane and air (say, CH_4=10 per cent.) under similarly normal conditions is 101 B.th.u. per cu. ft. Hence, the heat formed by the most explosive mixture of methane and air (marsh gas) in a motor is such that, if it were wholly absorbed by the motor, the temperature of the motor would be raised only by something of the order of from 0.5 deg. F. to 1.5 deg. F., depending on $v \times c/s \times w$,

where v = volume (cu. ft.) of gas space in motor,
c = calorific value of the gas (B.th.u. per cu. ft.),
s = average specific heat of the motor (which may be taken as 0.11 B.th.u. per lb. per deg. F.), and
w = weight of the motor in lb.

Of course, a richer mixture (up to CH_4=30 per cent.) may become ignited in a motor, and combustion somewhat assisted by air drawn in from the outside, but under no circumstances have motors appeared to suffer from the heating effects of explosion tests.

The Requirements of Vents.

An efficient vent must meet the following conditions:—

(i) It must form a path for the gas respired between the inside and outside of the motor, due to the heat changes associated with normal use, so that leakage of gas is not forced at the bearings and joints. As the volume of gas displaced by the "breathing" action is small relative to the time occupied by such respiration, any escape area which would produce a measurable effect on explosion pressures covers this requirement for normal breathing.

(ii) It must incorporate filtering, or sheltering, means of an extent which is compatible with the difficulties of the environment in which it is to function.

(iii) It must release as much explosion pressure as is possible, consistent with a flame barrier of reasonable proportions, and its usefulness in this respect mainly depends on (*a*) its position and (*b*) its escape area. Decision on the first feature has to be made with regard to the arrangement of the entire gas space formed within the motor, for, as already analysed, unless all sections communicate by paths of substantial section, explosion pressures may be very much higher in certain sections, and be almost unaffected by a vent in a badly selected position. When, as is general, it is possible to avoid conditions which would conduce to serious unequality of pressure, a vent in any position is useful. The release afforded in such a case depends chiefly on the ratio a/v, where a is the escape area in sq. in. afforded by the flame barrier, and v is the volume in cu. ft. of the internal gas space. The appropriate value of this ratio for a motor is a matter of much controversy owing to the diversity of opinions as to what extent it is necessary to afford pressure release. From explosion tests of which the writer has knowledge, it would appear that the percentage which the maximum pressure with release bears to that obtained with no release varies with the ratio a/v somewhat in the manner indicated in Table I.

(iv) The exact arrangement and depth of the gaps in the flame barrier do not materially influence the pressure produced, providing the gaps are straight in the direction of the flow of the escaping gases. Any departure from the last-mentioned feature may considerably reduce explosion pressure release, and should be avoided.

Table I.

Ratio A/v	Percentage which actual pressure bears to that obtained with sealed joints.	Comparative pressure values calculated on basis of 50 lb. per sq. in. with no release.
0	100 per cent.	50 lb. per sq. in.
.083	88 ,, ,,	44 ,, ,,
.19	78 ,, ,,	39 ,, ,,
.5	65 ,, ,,	32.5 ,, ,,
1.0	48 ,, ,,	24 ,, ,,
2.0	28 ,, ,,	14 ,, ,,
8.0	5 ,, ,,	2.5 ,, ,,

(v) It must be " flame-proof " to the extent that it will not pass inflamed gases such as could ignite an inflammable mixture forming the surrounding atmosphere. Modern knowledge of the laws governing the propagation of flame enables vents to be used with absolute safety. To this end the vent necessarily incorporates, or comprises, a flame barrier which almost invariably depends for its effectiveness on a number of metal plates, or elements, separated so as to form escape gaps of from 1/50 to 1/32 in. The temperature attained by inflamed marsh gas varies over a wide range, but is quite frequently about 3,500 deg. F.; the ignition point is 1,200 deg. F. (and then only if the temperature is sustained for some seconds). The absolute necessary amount of cooling is effected over the first inch of plates disposed as described, and in order to produce a good margin for safety the metal elements are made of somewhat greater depth, for which from 2 in. to 2½ in. is common, but seldom exceeded. The mass of metal in the cooling elements should be checked to confirm that any proportion of the total heat value of the internal gas which it may absorb will not increase its temperature unduly.

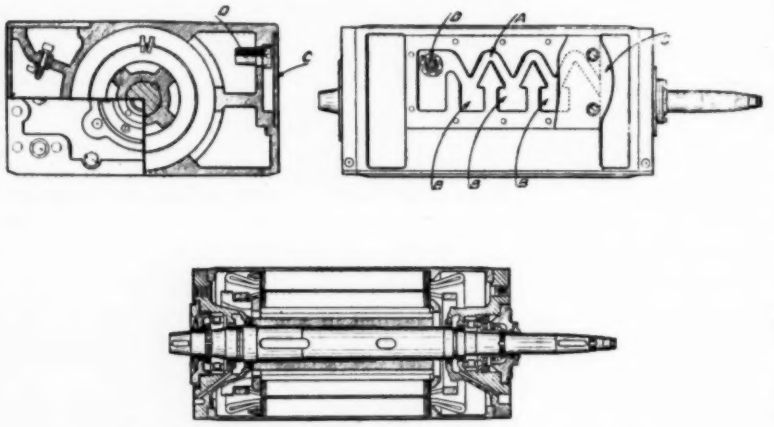

Fig. 1.—Arrangement of "Diamond" Type-26B/6 Coal-cutter Motor.

Types of Vent.

A practical design for most extreme conditions that incorporates all the features enumerated above is illustrated in fig. 1, which shows a well-known type of coal-cutter motor of which considerable numbers are giving satisfactory service in coal fields throughout the world. In this design the inlet is formed by coring out of the side of the motor case a channel A of large section, which is given a sinuous path so as to baffle the air from local turbulence and enable a channel of substantial length to be accommodated in a comparatively small space. At the inner end of the passage communication is afforded to the inside of the motor through a flame barrier D having elements of rustless metal. In this manner the gas is brought substantially still for an appreciable time, and conditions are produced which are conducive to the most complete deposition of dust and any water in excess of the natural humidity of the atmosphere, before the gas finally reaches the flame barrier and interior of the motor. Settling chambers B are provided so that the deposits lie away from the passage of the gas. The plate C, bolted over the channel, completes the encasement of the passage, secures the flame barrier D in position, and forms a ready means by which the whole breathing system can be exposed for inspection and cleaning. A special gas-tight jointing is used under the cover plate C; fig. 2 shows in detail the flame barrier D.

The above considerations apply to machines which have to operate under the worst mining conditions. To motors which are used under more moderate conditions vents have been applied, both as a means of supplementing the action of flange protection, and as inlets and outlets for the air that is circulated through the machine to cool it, as has already been described.*

The temperature of inflamed gas can be lowered in two ways: (*a*) hot gas passing through a narrow gap between cool metal surfaces gives up to the metal a portion of its heat, and (*b*) hot gas which is released under explosion pressure rapidly cools during its expansion. It is the latter phenomenon which renders gauze and perforated-metal plates† possible forms of flame barrier, but they are not used on motors because, under certain conditions, which can arise in such plant, they are not so reliable as plate protection. It is, however, sound practice to combine both cooling surfaces and expansion within one flame barrier.

Spring valves and covers fitted with release bolts have been tried on mining motors. This class of pressure-release devices includes an arrangement whereby a valve, or cover, is normally closed by one or more springs on to an opening in the " flame-proof " case; the pressure of an internal explosion overcomes the pressure of the springs, and the valve is lifted off its seating against a shoulder, revealing an escape gap of definitely limited area. This form of release does not compare favourably with plate release for many reasons, including the fact that the inertia of the cover prevents its action being sufficiently rapid to provide the maximum pressure release for the ultimate A/V ratio; and it does not cater for the passage of gas into the motor due to cooling and the inrush which follows an explosion.

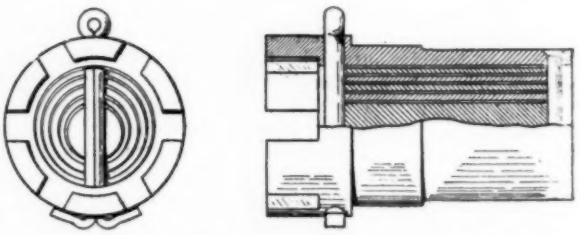

Fig. 2.—"Diamond" Cylindrical "Flame-proof" Vent.

The evident trend of modern practice for the literally " totally-enclosed flame-proof " motor to give place to the vented, or ventilated " flame-proof," motor is a development which has much to commend it for all conditions, from the worst to the most favourable, under which " flame-proof " motors have to operate.

The Eric Gérard Prize.—To commemorate the work of the late Prof. Eric Gérard, the Association des Ingénieurs-Electriciens Sortis de l'Institut Electrotechnique Montefiore, of Liége, Belgium, has instituted the Prix Eric Gérard, which is to be awarded every three years for the best paper on " Electricity and its Industrial Applications," prepared by a Belgian or foreign author, read before the Association and published in French in its Bulletin. The first award of the prize, which will be a sum of 1,000 francs and a medal, will be made in 1929. The Comité Scientifique will select what is regarded as the best paper presented to the Association in each of the next three years, making a final selection at the end of the period.

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* See Elec. Rev., January 29th, 1926.

†See conclusions of Safety in Mines Research Board, Elec. Rev., June 2nd, 1926, page 25.

The First National Radio Exhibition.—III.

A Review of the Exhibits.

By PAUL D. TYERS.

In the previous issues of the Review a brief summary has been given of some of the most interesting exhibits which were to be seen at this year's National Radio Exhibition. It was mentioned that on the whole no very startling developments have occurred, the general trend of progress having been along lines of greater emciency. So far as general methods of reception are concerned, the majority of sets employed ordinary straightforward tuned circuits, a great many neutralised receivers being present. Practically all multi-valve sets were either superheterodyne or had neutralised high-frequency amplifiers. One receiver, however, is particularly interesting, as it employs what may almost be termed a freak method of amplification. The set referred to was that shown by Auto Sundries, and appears to be manufactured under a patent taken out by Mr. A. H. Midgely. The amplifier is essentially resistance coupled, but the circuit and the values of the components and even the valves employed are so abnormal that it will be interesting to describe it in greater detail.

Technical readers will no doubt be familiar with the resistance amplifier, in which normal valves and grid leaks are employed, but the anode resistances, instead of being of the order of some 100,000 ohms, are of the order of 5 megohms. In this amplifier, however, the successive anodes are coupled by 5-megohm resistances through small coupling condensers to the succeeding grids. Another peculiar feature of the amplifier is that the valves are worked substantially at saturation. Ordinary valves are not employed, as those having anodes and grids of the order of $\frac{1}{4}$ inch in diameter and about 3/16 inch in length, with a very small filament are found to be necessary. The grids of the valves are substantially free, that is, there is no grid leak between any grid and earth. The last valve of the amplifier, which is used to operate the loud speaker, is of normal type, but the grid leak in this case is connected to the grid of the preceding valve. The set is used with a frame aerial, and with five valves very good strength is obtainable at an appreciable distance from the local station. One extraordinary feature of the circuit is the comparatively large output which is obtained with so small a wattage consumption. It is believed that the manner in which the circuit functions is even now not properly understood, but it seems probable that there may be some trigger action, or some quenching and super-regenerative effect. The set apparently is quite successful in operation, and its simplicity of manufacture should make it a very interesting proposition. One may understand, however, that more experimental and research work will be carried on with amplifiers of this description, in order that a proper understanding of the manner in which they function may be obtained.

Another development which, so far, has not been mentioned is the use of screened coils. There is nothing new, of course, in the screening of an inductance or transformer in a copper compartment, this method having been employed for many years. However, this year screened coils were to be found on several of the stands. Amongst them we may mention the "Lewcos" coil of the London Electric Wire Co., and the "Copex" coil of Peto Scott, Ltd. The design of a screened coil requires some careful attention, since one has to guard against losses. For example, it is very easy to arrange an inefficient screening which acts like a short-circuited secondary of a transformer.

The particular coils mentioned are screened by a copper cylinder, closed at one end, and making good contact with a metallic base, thereby totally electrically enclosing the coil. Screening of this nature is useful in two directions. In the first place, it localises the field surrounding the particular coil, thereby enabling a number of coils to be used in close proximity without any inter-action, the copper screening cases, of course, being connected together and earthed. The other advantage obtained by the use of a screen lies in the fact that such a coil has no direct pick-up effect. It is well known that if a two- or three-valve amplifier is used at some fifteen or twenty miles from a broadcasting station, and an ordinary cylindrical inductance such as those used within the copper screens is connected between the grid and filament of the first valve, a very good directional effect can be obtained by rotating the coil, quite appreciable signal strength being obtained when the cylindrical coil is directional with respect to the receiving station and the transmitting station. This effect is very greatly eliminated when a copper screen is employed which is electrically continuous. Screened coils were not to be found at the previous show, and it is safe to predict that their use is likely to be very considerably increased during the coming season, when, no doubt, several other types will be making their appearance.

Although the majority of wireless power problems are solved thermionically, that is, by the use of some form of valve or discharge tube in which there is an electronic discharge from some heated cathode, the ionic or gas discharge tube is now being utilised to a greater extent. Some years ago the American Radio Research Corporation produced the "Amrad S tube," which was a helium gas rectifier. This was suitable for rectifying at all voltages of the order of 500 to 1,000, and was used in this country by several amateur transmitters. Gas discharge rectifiers had not become very popular for some reason or other until recently with the British manufacturer, but now there seems to be further development in this direction. For example, Burndept Wireless, Ltd., has produced the "Ethotron," which is a full-wave rectifier suitable for operating high-pressure batteries, or delivering direct-current supplies to a receiver through some usual form of smoothing circuit. The ordinary neon lamp is also finding greater application in radio circuits, and was to be noticed in the show incorporated in Messrs. W. J. Henderson & Co., Ltd.'s, smoothing units. The gas rectifier, or, in fact, any type of tube in which no cathode heating current is required, should make an exceedingly popular appeal, since the power supply is one of the greatest worries to the wireless public. The further successful development of the gas discharge tube should prove an immediate success, and may almost be confidently expected in the very near future.

The Safety of the London Underground.—According to figures recently issued by the Ministry of Transport, the chance of a passenger being injured through a mishap to trains, rolling stock, or permanent way on the railways of Great Britain in 1925 was 1 in 4,500,000, whilst for fatal accidents it was 1 in over 1,700,000,000. During 1925 not a single accident to passengers was entailed through the working of the London Underground trains. In all, 319,000,000 passengers were carried, and the trains ran an aggregate of 14,182,000 train miles. This result may be largely attributed to the efficacy of the electro-pneumatic system of signalling in use, which permits of intensive train operation (certain sections of the Underground have the highest frequency of service of any railway in the world) with an infinitesimal chance of mishap. In the course of a day the signalling apparatus of the Underground—arms, trip-cocks, &c.—makes the enormous number of over 2,000,000 movements. A contingency such as a train overrunning a signal is provided against by a device which, should such an unlikely incident occur, would at once pull up the train and automatically set at "danger" the signals behind it.

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The Hydro-Electric Position in Spain.

From Our Special Correspondent.

Were the hydraulic projects which have formed the subject of careful study upon the part of some of Spain's most eminent hydraulic engineers to be brought to even partial realisation, the large annual coal bill could be greatly reduced. A steady increase is to be noted in the consumption of electricity for lighting and industrial purposes and for railway transport. Three years ago the power exploited did not exceed 600,000 h.p.; the end of the current year should see added at least a further 100,000 h.p., but still the total of 700,000 h.p. will be far below the figure for which concessions have been granted, namely, 1,500,000 h.p. Theoretically, Spain is capable of providing between 7,000,000 and 8,000,000 h.p.

Some engineers regard Spain as offering a field of hydro-electric exploitation richer than any other in Europe or even in the world, but their enthusiasm might have more justification were there fewer difficulties in the way of overcoming individual rights to rivers and waterways, and others arising from the jealousies of adjacent States respecting frontier encroachments. It is only when extensive projects are mooted that obstacles, which can be easily raised but less easily disposed of, have to be surmounted. Before any wide system of hydraulic works can be successfully undertaken, an immense amount of co-ordination will have to be entered upon within the country itself, and it is difficult to believe that this co-operation can be brought about except by special legislation and a very large (and partly unproductive) outlay of capital. Much, however, can be done by a strong Government such as that at present in power, and once the Council of Ministers has determined that a comprehensive scheme of water utilisation is necessary from a national point of view, objections and oppositions will be overcome, as they have been in some previous instances.

Something towards a general co-ordination of Spain's hydro-electrical opportunities has, indeed, been already effected by the creation of what is known as the Basin Commission. This newly-appointed official body has speedily got to work, and, as a preliminary, has declared available for exploitation five principal hydraulic basins, corresponding to the chief rivers of the kingdom. Following upon the definition as to area and capacity of these five basins, there will be brought into being a system of linking-up one basin with another so as to form a comprehensive national plan, effecting unification of transmission voltage, standardisation of machinery, and distribution facilities, designed upon a carefully-thought-out plan respecting the order in which construction should be undertaken. The cost of carrying out a project of such dimensions can only be approximately estimated; but the Basin Commission has been informed by its technical advisers that it must be prepared for a minimum outlay of 136,000,000 pesetas (roughly £4,000,000). Work is also being carried on by the Sociédad Española de Industría y Tracción Eléctrica, which was called into being by royal order little more than two years ago, in the direction of finding opportunities for the industrial exploitation of the country, particularly by means of railway construction and electrification, but also for the production of electricity in factories, workshops, and street-transport enterprises.

There is yet another point which will have to be carefully considered, namely, the position of contractors and concessionaires under the Spanish law as it now exists. With regard to any wide scheme of hydraulic exploitation in the country, a basic and wide-spreading alteration will have to be made in the decree issued in November, 1922, which, modifying previous legislation on the subject, stipulated that water concessions could only be granted for periods of between 65 and 75 years, except in special cases, when, as an uttermost indulgence, the life of a concession could be prolonged to a period of 99 years. At the expiration of the period all plant, buildings, and machinery would revert to the State without any compensation whatever.

It may confidently be stated that but for these discouraging conditions foreign capitalists would have come forward in larger numbers with assistance; but the strangulating effects of the Royal Decrees of June, 1921, which place such formidable obstacles in the way of obtaining favourable concessions, together with other restrictions on the provision of foreign construction material and rolling stock, have proved too formidable. On the other hand, Spanish capitalists have not the means of providing the whole of the capital necessary, and they are equally unable to furnish the requisite plant and machinery.

The Government is showing some desire to enlist the financial assistance of foreign capitalists, as, for instance, in the case of Messrs. Morgan & Co., of New York, and Messrs. Rothschild, of London, who, in conjunction with Messrs. Urquijo, a Spanish banking firm of Madrid and Bilbao, formed three years ago a syndicate capitalised at 500,000,000 pesetas, for the purpose of constructing electric railways in the country, the first of which will be that between Madrid and Valencia, 350 km. in length, double-tracked and electrified throughout. Neither is there any prejudice displayed against the employment of foreign engineers, as has been proved by the selection of two Tasmanian experts (Messrs. Charles Adams and R. F. Waller) to supervise the construction of the new railway between Santander and Calatayud.

Under these severe regulations, however, several enterprises of importance have already been built, such as the power station from which is derived the power for working the electric railway from Granada to the village of Durcal, 35 km. in length, and where a battery of accumulators, comprising 580 double cells, with a capacity of 44 ampere-hours at 1,200 volts, forming the largest installation of its kind to be found at present in Spain, has been installed.

In the Provinces of Salamanca and Zamora, the falls on the Rivers Esla and Tormes, both of which are situated in Spanish territory and represent a power of about 200,000 h.p., are awaiting an agreement with Portugal before they can be harnessed for the provision of industrial and transport power. A Spanish concession for 99 years for their utilisation was granted some time ago, but before it can be availed of, not only must there be a settlement of the Portuguese objections that have been lodged, but a more certain way must be found to make the scheme remunerative to the undertakers.

The Shannon Power Scheme.—As stated in our issue of September 3rd, p. 366, a permanent Commission is about to be set up by the Irish Free State Government for the purpose of controlling the Shannon Power Scheme. Already several names are mentioned in connection with the appointments to this Commission, and it is believed that the Hon. Mr. Gordon Campbell, who holds the position of Secretary to the Ministry of Industry and Commerce, will be the chairman of the new permanent Commission. Since the origin of the scheme and the commencement of the operations, Mr. Campbell has been largely responsible for the Government administration in connection with it, and his appointment as head of the Commission will, to a certain extent, be a continuation of his activities. During the past few months, work on the scheme has developed to a great extent, and is actually ahead of schedule. There are at present some 2,500 men employed at the works, of whom 2,100 are Irish, and the wages bill runs to something like £10,000 per week. Apart from the engineering work, the general administration is becoming a larger and a more complicated business, requiring the whole-time attention of a unifying controlling body, such as the proposed Commission and its staff will be in the near future.

Electricity Supply.

Report of the Minister of Transport.

THE report of the Minister of Transport on the applications to and proceedings of the Deparament under the Electricity Supply Acts for the year ended March 31st, 1926, was issued recently (H.M. Stationery Office, price 1s. 3d. net). It records the coming into operation of the London and Home Counties and the West Midlands Electricity District Orders, and the confirmation of 67 Special Orders for establishing new or extending existing electricity supply undertakings, as well as three bulk supply Orders. At March 31st the Minister had under consideration sixteen Electricity Special Orders and two Bulk Supply Orders which had been submitted to him by the Electricity Commissioners for confirmation. Orders were made for the revision of maximum prices in ten cases. The Tenby Corporation electric lighting Order was revoked, but applications for the revocation of powers in three other cases were not granted. Consent was given to the erection of overhead lines in connection with no fewer than 98 undertakings. Twenty applications for consent for wayleaves were dealt with, of which fifteen were granted and the remainder were settled by agreement; two applications for the retention of existing mains were also acceded to.

The estimated expenses of the Electricity Commissioners for the year ending March 31st, 1926, were approved; the amount was £53,000, compared with £67,000 in the previous year, the reduction being due to the final discharge of the liability to the Treasury in respect of advances made to meet the expenses of the Commission during the first two years of its existence, which took place at the end of the previous year.

The Electricity Commissioners granted 17 applications relating to the establishment of new generating stations, 10 of which were statutory; 90 applications relating to extensions; and 42 applications relating to main transmission lines. The aggregate capacity of the generating plant sanctioned during the year was 585,700 kW, of which the new stations accounted for 46,460 kW. During the year 694 applications from local authority undertakers for sanction to borrow money were received, and 107 applications were brought forward from the previous year; sanctions were issued in respect of 588 applications, 29 were otherwise disposed of, and 184 had not been dealt with at the end of the period. The total amount of the loans sanctioned during the year was £9,696,557.

The Commissioners had 79 applications for Special Orders in hand, and received 93 more; Orders were made in 70 cases, 8 applications were refused, 6 were withdrawn, and the remainder (88) were under consideration at the end of the period. They approved of 25 agreements between authorised undertakers for mutual assistance, and issued two Orders authorising bulk supply. Fringe Orders were made in 106 cases, special systems of supply were approved in 15 cases, and change of system and/or pressure was authorised in 15 cases.

Reviews.

Coal- and Ash-Handling Plant. By JOHN D. TROUP, M.I.Mech.E. Pp. viii+148; fully illustrated. London, 1926: Chapman & Hall, Ltd. Price 13s. 6d. net.

The handling of coal and ashes at a modern power plant has become an engineering problem of recent years owing to the increase in plant capacity of power stations and gas works and the necessity of adopting a system of mechanical handling. So many types of plant have now been developed for fuel and ash handling that the problem has become rather intensified, and whilst the most suitable plant for any given set of conditions is usually decided by compromise, the appearance of a handbook on the subject is most opportune.

The author has aimed at collecting in a single volume the available information on coal- and ash-handling plant, and throughout the work he has endeavoured to keep in mind the conditions obtaining in both large and small power plant.

The problem commences with the handling of the fuel on arrival at the power plant, and continues right through to the disposal of the incombustible products, such as ash, clinker, soot and flue dust, the subject being arranged in this order with descriptions of the various appliances in use for each stage of handling.

Coal is usually either water borne or rail borne to the plant, and after unloading the barges or wagons the fuel has to be elevated to a suitable height for transference to the bunkers or furnace hoppers. The discharging of railway wagons by ram tippers and rotary tipplers is described and illustrated, and these systems have been largely adopted in power stations for the rapid unloading of coal. If the coal is fine and wet, there is a tendency for it to stick on the bottom of the truck with the tipper gear as mentioned by the author, and the same fault is, of course, common to the tippler, whilst, in addition, one may have occasional trouble with the wagon axle boxes losing oil. Both ram tippers and rotary tipplers give quick and good service in wagon handling, and the speed given for the rotary tippler of six wagons per hour, with two men, can easily be exceeded, though naturally much depends upon the class of coal being unloaded and the lay-out of the railway sidings at the tipplers or other appliances.

Coal elevators are fully considered and the various types explained, typical lay-outs of gravity bucket, tray and belt conveyors being given, whilst skip hoists which are useful for rapid handling are also touched upon. Grabs are also dealt with, and although the method is very useful and, in fact, sometimes a necessity, the maintenance is apt to be rather higher than with conveyor plant, and the human factor has also to be considered in practical working. The pneumatic system of handling is explained and several installations described, but it can hardly be said that it has yet passed through the state of development necessary for coal elevating in large modern power stations using various classes of coal. The cleanliness and flexibility of operation of pneumatic coaling plants are perhaps the chief points to be weighed in their favour.

A useful chapter deals with the subject of automatic coal-weighing appliances, and various types of machines are described and the Lea coal meter and cubi-meter are explained.

Coal storage is a problem that besets both the designer and the manager of a modern power plant, and a brief outline of some of the methods in use for the handling and storage of coal is given in the seven and a-half pages devoted to this important subject. One feels that the notes on concrete bunker construction in this chapter have tended to absorb a large portion of the text which might have been given to descriptions of coal storage and reclaiming systems.

Coal-conveying plant has passed through important developments with the increasing size of power stations, and the author describes the general features of most of the modern systems in an interesting chapter. Belt conveyors are adequately dealt with, and there is no doubt that the modern belt conveyor is in practice one of the most satisfactory and quickest types of coal-handling apparatus yet developed.

In the handling of ash and clinker special difficulties are met with on the power plant, and engineers will be interested in the author's descriptions of the various types of plant that have been developed as a solution of the problem. Mechanical, water-sluicing, and pneumatic systems are dealt with, and where cleanliness of the boiler house is essential, the water trough or sluicing systems are being largely adopted. It is gratifying to note that the author has devoted a chapter to the handling of coal and ashes by means of aerial ropeways, such methods being capable of considerable development in this country for power plants.

Flue dust and soot-removal apparatus is fully considered in the text, and vacuum sooting plant and dust catchers are described, the latter being an attempt to develop an efficient method of arresting grits and large particles present in flue gases. Finally, an interesting chapter is devoted to methods for the recovery of unburnt fuel, and in this development the Continent is at present leading the way in regard to modern installations.

The book is excellently illustrated, and is written from a practical standpoint, so that it should appeal to boiler-house engineers and those interested in the design and operation of modern power plants.

L. M. J.

Modern Telpherage and Ropeways. By HERBERT BLYTH, M.Inst.C.E. Pp. xviii+156; figs. 127. London, 1926: Ernest Benn, Ltd. Price 27s. 6d. net.

The handling of materials by modern methods is becoming an increasingly important problem in the various industries of this country, and it is only by the adoption of the most up-to-date appliances that production costs can be kept down to the lowest economic figure in works practice.

The subject is of considerable interest to engineers engaged upon the design or management of electricity works and power plant generally, because a cheap and reliable system for the handling of the fuel and ashes is an important factor in the overall cost of production in these days of high labour cost and industrial unrest. Coal handling alone is becoming a more complex problem each year with the growth in capacity of power stations and the increasing necessity of having to keep perhaps two or three months' reserve stock of fuel on site to insure against labour troubles.

The object of the present volume is to illustrate clearly the general principles and practical considerations underlying the application of telpherage and ropeways to conveying problems, and the author has freely incorporated in the work his experience of telpherage systems since their inception in this country about 25 years ago.

The book is conveniently divided into three sections, dealing, respectively, with modern telpherage, modern ropeways, and modern cableways, the major portion of the volume, however, dealing with telpherage. The relative merits of telpherage and ropeways are fully considered, and also combinations of the various systems, and the detailed descriptions of actual installations with technical data should prove of value to engineers concerned with handling problems.

It is of interest to note that telpherage was invented by the late Prof. Fleeming Jenkin about 44 years ago, the essential features of his system being a single-track rail, the machine which travels upon it, and the conductor or conductors which supply current to the motors. The active development of telpherage in this country, however, dates back some 20 years, when installations for gas and electricity works were carried out, although both in America and Germany rapid develop-

ments had already taken place. The system has now been generally applied to the handling of materials, and the author gives particulars of many of these installations in the 12 chapters devoted to the subject.

The application of telpherage to coal handling in power stations is adequately considered in two chapters, the installation at the St. Pancras electricity works being quoted as an example of coal and ash handling equipment, and details of the construction of this plant are given, together with some useful figures as to operation and maintenance costs.

The coal and ash-handling plant at the Cossipore power station at Calcutta is another interesting example of the application of telpherage to modern power house requirements, and in describing this installation the author goes fully into some of the special difficulties of design that were encountered, and gives particulars of the structural work involved.

The problem of storing coal and other minerals in "dumps" or stock heaps, and the necessity of reclaiming materials rapidly and economically, exercise the minds of power-station engineers to a greater extent each year, and as so many systems have already been developed the choice of the ideal method is rather a difficulty in any particular case. Reclamation of the coal or other material from the dump or storage silo is probably the greatest difficulty, and the system of reclaiming by gravitation from the bottom of the store on to a conveyor system below ground in tunnels, is usually too expensive in capital cost to be seriously considered.

The salient features of four of the best-known systems for dumping and reclaiming coal or similar materials are considered, and the author gives examples illustrating modern practice in this respect in power plants. The particulars given should prove useful to engineers responsible for the design of power stations and other plants where coal handling is a feature of the layout.

Grabs and skip loading devices are important features of telpher systems, and two chapters have been devoted to descriptions of some of the best known appliances, skip loaders being essentially time-savers in cases where the skip system can be adopted. The constructional details of telpher runners and bogies are considered, and the writer describes the various methods applicable to the distant control of telpher machines, both on the semi-automatic and the fully-automatic electric control systems.

Telpherage applied to the handling of general merchandise at docks and railway warehouses, together with track switching and automatic weighing systems, forms the subject of a separate chapter. The capital charges and operating costs of telpher plant on coke handling at gasworks are fully gone into by the author, and the final chapter of the section is devoted to design calculations for high telpher tracks of long span subject to wind pressure.

The second section of the book is devoted to ropeways, and contains four chapters illustrating typical applications. The commercial value of ropeways has not yet been fully appreciated in this country for the handling of materials, for no other system of mechanical conveying possesses such cheap operating costs or such low capital and maintenance charges. There are possibly objections to ropeways in many cases on account of the necessity of obtaining wayleaves over or alongside roads, canals or railways, but the small ground space required for the towers is generally a matter of a merely nominal rent. In certain foreign countries there is a "Ropeway Law" in virtue of which wayleaves can be enforced for industrial or public utility purposes. The ropeway is, of course, particularly suitable for difficult ground conditions, and spans up to about one thousand yards or so can be adopted in such cases to ensure suitable sites for the towers in hilly country, whilst rivers and docks, &c., are easily negotiated.

The author, after describing various ropeway systems, considers some of the essential features of design and construction and the use of automatic and non-automatic terminal stations for both mono-cable and bi-cable systems. It is interesting to note that although aerial ropeways are generally used for longer runs than telphers or conveyors, the writer believes that there are many cases of coal and ash handling where a ropeway system would prove to be the most economical solution to the problem.

The final section and chapter of the volume deals with cableways, as distinct from ropeways, and the author differentiates between aerial ropeways and cableways by defining the latter as having a hoisting unit in addition to the travelling or conveying system. The more modern application of the cableway is to cable cranes for long spans, and descriptions of several interesting installations are given.

Throughout the volume the author has carefully considered the important factors of capital charges and operation and maintenance costs, bearing in mind the fact that the ultimate purposes of mechanical handling are to facilitate work, to increase efficiency, and to reduce the costs of production.

The book is lucidly written and exceptionally well illustrated, and should prove valuable as a work of reference to engineers concerned with the handling of materials.

L. M. J.

Business Notes.

Commercial and Industrial Developments, Business Changes, Trade Opportunities, New Publicity Literature, Liquidations and Failures.

Our Second Trade Names Supplement.—Accompanying the present number of the Electrical Review we are circulating the second of our Quarterly Trade Names Supplements. It contains a considerable number of new entries, and is in a slightly altered form.

The Development Campaign.—Mr. H. Walker (Messrs. Walker Bros.) presided on Tuesday last week at a well-attended and representative meeting of manufacturers and others in the electrical trade of Birmingham (at the Smoke Abatement Exhibition), which was addressed by Mr. J. W. Beauchamp (Director of the Electrical Development Association) upon the propaganda. Mr. W. A. Baxter (Messrs. Baxter & Impey), in moving a vote of thanks to Mr. Beauchamp, appealed to all engaged in the electrical contracting industry to give the movement their support. Never before, he declared, had a better opportunity occurred for co-operation. The question of the provision of electricity in the home was one of public interest, and while those engaged in the trade must benefit to the extent to which the wiring of houses was done, the fact must not be lost sight of that the increased use of electricity would make not only for smoke abatement, but for the cleanliness of the home, as well as economy in the working of it.

The resolution was seconded by Mr. W. Berkeley, who pointed out that in the propaganda movement it was essential that a supreme effort should be made to secure the support of the ladies, of those whose lives were spent in great degree in the home. Mr. Beauchamp, in reply, stated that the Women's Electrical Association was a very strong and growing body. The women's branches were doing their part, and it was intended that the advertising should be of a kind that would appeal to women. He entertained the hope that women would ultimately pay as much regard to the electrical shops as they did to the milliners'. A great point to make in propaganda was that they were rendering an important public service which made for healthy and happy homes. This aspect of the matter was, in fact, generally admitted. To Mr. Walker a vote of thanks was passed for presiding, on the motion of Mr. Jennings, of the Birmingham Electric Supply Department. The word "co-operation" had been used, he observed; he did not think that, so far as the Birmingham district was concerned, they could have more co-operation between the various branches of the industry than they had already. Manufacturer, wholesaler, contractor, retailer, and supply authority were represented there on the platform, and they were working wholeheartedly in this matter.

A number of meetings was held during the Smoke Abatement Exhibition at Bingley Hall, Birmingham, and lectures were given by Mr. G. S. Francis on the use of electricity in the home and in the workshop. Speaking on Wednesday last week, he pointed out that electricity was an extremely protean form of power, and could be applied for practically every purpose of human activity. Lady Brooks presided at one of the afternoon meetings.

Electricity Meters Approved.—The Electricity Commissioners have approved of the Electrical Apparatus-type "E" induction watt-hour meter, rated from 2.5 to 20 A at from 200 to 250 V, frequency 50 cycles, the Ferranti-type continuous current mercury Ah meter, rated from 2½ to 20 A, and the Ferranti-type "C" single-phase a.c. meter, rated from 2½ to 20 A, frequency 50 cycles.

Illumination Design Course.—For the benefit of those who are unable to attend its four-day courses, the Electric Lamp Manufacturers' Association has arranged a course of winter-evening lectures and demonstrations. These will be held fortnightly, on Mondays, and the following is a list of the subjects to be dealt with:—Lighting fundamentals and principles of light control; simplified methods of designing illumination schemes; the art of home lighting; electric-lamp manufacture and the economics of light production; light as a decorative medium; the lighting of shops and stores; the principles of flood lighting; the possibilities of colour lighting; and selling better lighting. Those desirous of attending the lectures should apply to the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, Strand, W.C.2, for a ticket of admission; as the accommodation is limited to 100 early application should be made.

Battery Locomotives for Shunting Work.—Amongst recent orders secured by Messrs. Electromobile, Ltd., of Otley, are two for storage-battery locomotives—two for a large gas-works, and two for the Admiralty. Similar locomotives have been supplied to large steel works, chemical factories, and waterworks for shunting purposes.

Electrical Manufacturing in the United States.—In the course of an address at the recent annual convention of the Association of Electragists International, Mr. Gerard Swope, president of the General Electric Co., repeated a statement that the value of the annual production of electrical goods in the United States was in the neighbourhood of $1,400,000,000, and said that of this the General Electric Co. produced 22 per cent., and the Westinghouse Company 11 per cent.

American Enterprise in Russia.—It is reported that representatives of the General Electric Company (U.S.A.) are in negotiation with the Soviet General Electric Commission concerning the proposed establishment of two works in Russia for the manufacture of lamps and other electrical products under a 24-year concession. The whole of the production in the first three years would be purchased by the Soviet Government. The American interests are credited with the intention of selling the products of the two works also in China and Persia. It is said that they intend to devote $10,000,000 to the working of the concession, which has not yet been approved.

Warrington Civic Week.—During the Civic Week at Warrington, which is to be held from September 25th to October 2nd, the Corporation electricity works will be open to the public. The Electricity Department has taken two large stands in the Exhibition of Local and Empire Manufactures, and will display and demonstrate all types of domestic electrical apparatus. Electricity for internal and external illumination and advertising schemes will be supplied at 1d. per kWh during the week.

Electric Signs at Bury.—The accompanying illustration

Bury Electricity Showrooms, Jubilee Decorations.

shows the front of the Bury Corporation Electricity Department during the Jubilee week, which was held recently.

The Australian Radio Market.—In the course of a speech at a meeting of exhibitors and others at the National Radio Exhibition last week, Mr. L. A. Saunders, editor of the *British Trader* (Australia) said that although during the last three and three-quarter years Australia had imported radio apparatus of the value of £6,000,000, only £700,000 worth of that was of British manufacture. He endeavoured to show that broadcasting was of far more value in Australia than in this country, especially in the isolated country districts. British apparatus was not always easy to obtain; it should be, however, and manufacturers should make an effort to secure a proper share of the trade. Mr. E. A. Harney, K.C., M.P. (chairman), said that Mr. Saunders had revealed a grave state of affairs. He considered that the Commonwealth would do well to ensure, by means of its tariff system, a fair market for British goods.

Electrical Equipment in Mexico.—As a result of the new electrical code recently introduced into Mexico by the Government, raising and standardising the class of equipment permitted to enter the country, a wider demand has been created for electrical equipment and apparatus. Owing to the political and religious unsettlement, trade is generally dull and collections on account are somewhat difficult, but a marked improvement in the electrical industry is noted. This trends towards sales of electrical apparatus of superior makes. The use of cheap grades of lamp wire and sockets is prohibited by the new regulations. Supplies of cheap German sockets are to be withdrawn from sale. All electrical installations must in future conform strictly to the new code, which is not expected to affect the large electric light and power companies.—*Reuter's Trade Service* (Mexico City).

The Electrical Market in El Salvador.—In view of the wider use of electricity in the principal towns of El Salvador (owing to the more moderate duties now imposed by the Government) the market for electrical supplies has broadened considerably. While local manufacturers maintain small stocks, owing to rapid deterioration in the tropical climate, the brisk demand for apparatus from several districts has led to more substantial orders being placed abroad. An attempt by German manufacturers to capture the market has not succeeded, owing to the inferiority of the goods exported. United States goods are more in favour, but British goods have given the greatest satisfaction. There is a fair market for flash lamps, and batteries are also in good demand. The Leclanché type is, perhaps, the best known. Broadcast receiving sets, electric bells, fittings and domestic appliances are largely of United States manufacture.—*Reuter's Trade Service* (San Salvador).

Baltic Orders.—It is stated that 12 firms participated in a competition opened by the municipal council of Riga for the supply of a turbo-generator of 10,000 kW for the extension of the city power station, the order being entrusted to the Berlin A.E.G. After keen competition the Finnish Government is reported to have allotted to the Hermsdorf-Schomburg Insulator Works Company an order for the delivery of the insulators for the 100,000-volt lines from the Imatra generating station to the towns of Helsingfors, Aaborg and Wiborg. American firms are said to have received the contracts for the insulators for the l.p. lines.

The Hydro-Electric Outlook in Canada.—"A study of the probable cost of future turbine installations in Eastern Canada indicates that between 1926 and 1945 about $1,300,000,000 will be required in capital expenditure, or that the average expenditure per year for the next 20 years will be close to $65,000 000," says the current monthly letter of the Royal Bank of Canada, in discussing the Canadian hydro-electric industry. "In making this estimate the Dominion Water Power Branch of the Department of the Interior conclude that of this total about $600,000,000 will be required in Ontario and nearly $700,000 000 in Quebec. Even more startling results would be obtained by showing the capital investment and the man-power necessary for the growth of the power-using industries which will develop during the next 20 years. For these estimates the area considered is bounded by lines struck at about 300 miles radius from Toronto, Montreal, and Quebec, so that it may include waters within practical transmission distance of the principal industrial districts. Northwards, towards the mouth of the St. Lawrence, the area extends nearly 200 miles beyond the Saguenay River, and includes the Manicaugan River; westward it includes the mining districts of Cobalt and Sudbury, and southward it includes the whole of the Niagara peninsula."

German Contracts for Russia.—As a result of differences of opinion between the Soviet Trading delegation in Berlin and the German electrical industry regarding prices, it is stated that until recently orders for only 1,000,000 marks had been allotted to the latter out of the German State credit of 70,000,000 marks destined as a guarantee for the purpose, while at the same time English firms have been given contracts for turbines, turbo-generators, motors, &c., representing 79,000 kW. Now, however, an agreement appears to have been reached, as it is said that the delegation has placed orders with German works for the delivery of plant for 107,000 kW, Brown, Boveri & Company, of Mannheim, being mentioned as the successful firm.

Time Switches.—MESSRS. VENNER TIME SWITCHES, LTD., have received contracts for time switches for public lighting service at Dublin and at Londonderry. It is 15 or 16 years since they first supplied time switches to Dublin.

G.E.C. Selling Campaigns.—We have received some particulars of the "Osram" lamp sales and advertising campaign for 1926-1927 of the General Electric Co., Ltd. This firm will shortly circularise to about a million electric-lamp users a booklet designed to create a profound and lasting impression, treating of the vastness of the organisation behind the "Osram" lamp. Intensified Press advertising will also be carried out, with posters printed in colours, which should find a place in every electrical dealer's window and showroom. Full particulars of this campaign have been sent to the trade by means of an attractive and compelling "broadside," entitled "Mass Selling to the Millions," which describes the forthcoming "Osram" lamp advertising activities.

The General Electric Co., Ltd., is also embarking upon an extensive publicity campaign for promoting the sales of Osram wireless valves for the present wireless season. It consists of wider advertising and the circulation of counter showcards, streamers, &c.

For Sale.—Mr. H. J. Shaw will sell by auction, on September 30th, at 13, High Holborn, W.C., the stock of an electrical goods factor. (See our advertisement pages to-day.)

New Swiss Company.—The Glas-Gleichrichterbau Gesellschaft is the name of a new company which has lately been formed in Bischofszell (Canton of Thurgau) to manufacture glass mercury rectifiers.

An American Company's "Customer Dividend."—The *Electrical World* says that the directors of the Hartford Electric Light Company have authorised another customer dividend to be paid in October this year. The dividend will be in the form of a rebate of 60 per cent. on the amount of the October bills and will total over $250,000. A year ago in October a 50 per cent. customer dividend was returned to the customers and amounted to $225,000. A payment of $6.25 as a premium charge on an issue of 10,000 shares in 1920 will be returned to stockholders.

Household Appliances. — The Household Appliances Section of the London Chamber of Commerce will hold a luncheon at the Holborn Restaurant on Tuesday, October 12th, at which Sir Ernest Benn will speak on "How Labour-saving Devices in the Home Help the Nation."

The Cable Makers' Association.—The British cable-making industry stands out as an example of organisation which is probably unparalleled in the electrical industry. The Cable Makers' Association was formed in 1899, and since that time it has rigorously guarded the standard of manufacture, and the term "Association" applied to cables and wires has become a guarantee of thorough manufacture and safety. In a booklet which it has recently produced the Association states

its aims, and describes its organisation for the fostering of scientific research and efficient production. The means of securing peace in the industry are described, and it is endeavoured to show that the profits of cable manufacturers are not excessive, as is often stated.

The West Midlands Electricity Authority.—All communications for the West Midlands Joint Electricity Authority, or for Mr. S. T. Allen, the chief engineer and manager, should be addressed to Phœnix Buildings, Dudley Road, Wolverhampton—the new and permanent address of the Authority.

Hungarian Import Regulations.—The *Board of Trade Journal* of September 16th published a list of goods which must be accompanied by a certificate of origin upon importation into Hungary. The list includes dynamos, motors, transformers and parts, and electrical machines in mechanical combinations; internal combustion engines; pumps; and iron chandeliers for electric lighting, table lamps, &c.

Trade Announcements.—With reference to the new company, M.C.L. & REPETITION, LTD., mentioned in our last issue, we understand that Mr. A. H. Midgley, of the Midgley Car Lighting Co., will continue as electrical engineer to the new company, and Mr. J. W. Steer, long associated with the business of George H. Alexander Repetition, Ltd., will be general manager of the new concern. The liquidation of the Midgley Car Lighting Co., Ltd., is only a matter of form, due to its assets being taken over by the new company.

MR. HENRI ENGEL has removed to Paurelle House, 91, Regent Street, W.1. His telephone number remains the same:—"Regent 4354."

MR. STANLEY N. WATKINS is removing to 107, Dale End, Birmingham, by September 30th, and he asks for manufacturers' trade price lists.

MESSRS. WINGROVE & ROGERS, LTD., Mill Lane, Old Swan, Liverpool, have recently acquired the business of British Electric Vehicles, Ltd., Southport. The firm has been manufacturing controllers under their own patents for the British Co. since 1919, and they will now manufacture complete all standard designs of B.E.V. electric trucks and locomotives in their factory at Liverpool. The present management and the technical staff of British Electric Vehicles, Ltd., are being retained so that continuity of design will be secured. Application has been made to the Board of Trade to amalgamate the two names in the form of Wingrove and Rogers British Electric Vehicles, Ltd.

Mr. E. C. OSBORNE has taken over the wireless business of Mr. F. Launchbury at 17, Bridge Street, Boston.

Mr. H. C. BATES is opening an electrical showroom at 26, Corporation Street, Chesterfield.

Messrs. R. MILLETT & SONS, 55, King Street, Ramsgate, are extending their wireless and electrical department.

Messrs. KENT BROTHERS ELECTRIC WIRE CO. & E. H. PHILLIPS, LTD., announce that Mr. Arthur E. Luen, of 98-100, Queen Street, Cardiff, is no longer acting as their representative, and that they have appointed the Sloan Electrical Co., 44, Victoria Street, Bristol, as their representative for South Wales and the West of England.

MESSRS. SATCHWELL & GITTINGS, of Walsall, are opening offices and showrooms for London and the South-Eastern counties, at 6, Dowgate Hill, London, E.C., under the management of Mr. A. H. Lucock. Telephone No.: "Central 4570."

It is announced in the British Chamber of Commerce *Journal*, Shanghai, that the BRITISH ELECTRICAL & ENGINEERING CO. OF CHINA, LTD., has been taken over by the Jardine Engineering Corporation, Ltd. Mr. R. A. E. Denton and Mr. C. W. Pennett, of the first-named company, are now attached to the Jardine Engineering Corp., the former as special representative of the National Gas Engine Co., Ltd., and Mirrlees, Bickerton & Day Co., Ltd., and the latter as special representative of Messrs. W. T. Henley's Telegraph Works Co., Ltd.

We are advised that owing to the Westminster Council having decided to re-number a portion of Charing Cross Road, Metro-Vick House will in future be No. 155, Charing Cross Road, not 145, as at first.

Mr. H. J. ARTHUR, electrical engineer and contractor, who is leaving his address in Cannock Road, asks that all correspondence should be sent to him at Broad Lane, Bradmore, Wolverhampton.

Catalogues and Lists.—CALLENDER'S CABLE & CONSTRUCTION CO., LTD., Hamilton House, Victoria Embankment, E.C.4.—A booklet describing in detail the "Kaleeco" wiring system. Illustrated.

WANDSWORTH ELECTRICAL MANUFACTURING CO., LTD., Imperial Works, Ludgate Hill, Birmingham.—Twenty-page pamphlet, entitled "Truth in Advertising." The list opens with the statement that the series of fortnightly advertisements run by the Company in the ELECTRICAL REVIEW during six months in connection with our first Advertisement Competition increased their sales by 25 per cent. It will be remembered that the Company's entries were awarded a special prize of £50. Particulars and prices follow of Wandsworth shock-proof switches, switch plugs, quick-make and-break switches, grid boxes for flush-type switches, also "Underslung" switches.

THE CHLORIDE ELECTRICAL STORAGE CO., LTD., Clifton Junction, near Manchester.—A brochure dealing with batteries for country-house lighting, and another describing applications of Chloride batteries in sea-going vessels.

BRITISH THOMSON-HOUSTON CO., LTD., Crown House, Aldwych, London, W.C.2.—Attractively-designed and produced catalogue giving excellent illustrations (partly in colour) of various types of B.T.-H. electric lamps for all classes of service, together with prices and a good deal of general information of value to the trade. The company's new motor-car lamp and a number of colour-sprayed daylight and white "Mazda" lamps are included. Publication A.G.201, containing very full particulars of "B.T.-H." radio valves. Also a priced pamphlet dealing with the same subject and a leaflet advertising the company's telephones and loud speakers.

METROPOLITAN-VICKERS ELECTRICAL CO., LTD., Trafford Park, Manchester.—A number of new and revised leaflets have been issued for insertion in the catalogues already in the hands of the trade. They relate to induction motors, phase advancers, motor starters, switchboards and switchgear, measuring instruments, &c.

HART ACCUMULATOR CO., LTD., Marshgate Lane, Stratford, London, E.15.—That the Hart battery is the ideal one "on the road or in the home" (for motor-car starting and lighting and wireless) is the story told by the Company's window-space showcards prepared by the Company for use in the carriages of the Central London Railway. The company has also issued a showcard (H11) which incorporates a photograph of Mr. De Groot, of the Piccadilly Hotel, with words intimating that that well-known violinist uses Hart h.t. accumulators.

M. PAUL DIENY, 21, Laurence Pountney Lane, E.C.4.—Illustrated pamphlets advertising phase-shifting transformers and a "daylight" colour-matching apparatus.

AUTOMATIC & ELECTRIC FURNACES, LTD., 173-175, Farringdon Road, E.C.1.—An illustrated pamphlet dealing with the use of "Wild-Barfield" electric furnaces for tool- and gear-hardening, &c.

MESSRS. S. SMITH & SONS (M.A.), LTD., Cricklewood Works, N.W.2.—A booklet dealing with the company's batteries for automobile starting and lighting.

SIEMENS & ENGLISH ELECTRIC CO., LTD., 38-39, Upper Thames Street, E.C.4.—Catalogue No. 157, containing an illustrated description of the "Seelco" wiring system. The company has also issued a folder illustrating various advertising media for use in its lighting "campaign."

MESSRS. SIMON-CARVES, LTD., 20, Mount Street, Manchester.—An illustrated brochure dealing with pulverised fuel firing for boilers.

IMPROVED APPLIANCES, LTD., 43 & 44, Fetter Lane, E.C.4.—The "Fire Hazard News," advertising the "Safe-Economy" electric iron.

THE GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2.—Pamphlet describing and pricing the "Magnet" electric suction cleaner.

BROOKHIRST SWITCHGEAR, LTD., Northgate Works, Chester.—Monthly calendar cards, October to December, 1926, illustrating their new air-break a.c. small-power control gear. A priced catalogue of small power gear is in the press.

THE GLASGOW ELECTRICAL ENGINEERING CO., LTD., 45-47, Pitt Street, Glasgow.—Publication No. 626, describing the latest types of the company's wind-driven dynamos.

W. T. HENLEY'S TELEGRAPH WORKS CO., LTD., Holborn Viaduct, E.C.1.—"Autumn Time in London Town," a pamphlet containing a picture of a quiet London street, the main feature of which is a "Henley" distribution pillar.

MESSRS. L. ANDREW & CO., 2, Whitworth Street West, Deansgate, Manchester.—A price list of "Wrendal" and "Capella" electric lamps.

MESSRS. E. P. ALLAM & CO., LTD., 107-109, Gray's Inn Road, W.C.1.—Monthly stock list of d.c. motors.

MESSRS. JOHN BENNIE, LTD., Moncur Street, Glasgow.—A reprinted article upon the company's lists.

THE LONDON ELECTRIC FIRM, Brighton Road, South Croydon.—A series of illustrated leaflets dealing with searchlights, flexible couplings, winches, pulleys, lamp-lowering gear, carbons, &c.

MESSRS. H. & C. DAVIS & CO., LTD., 1, The Pavement, Clapham Common, London, S.W.4.—Illustrated price list of electrical accessories.

MESSRS. VENNER TIME SWITCHES, LTD., 45, Horseferry Road, Westminster, London, S.W.1.—List No. 33, in the form of a *résumé* of the present position of late shop window lighting in this country.

MESSRS. ARNOLD & SONS, 50-52, Wigmore Street, London, W.1.—A pamphlet dealing with the measurement of Ultra-Violet Dosage.

Bankruptcy Proceedings.—H. PADGETT and A. NICHOLSON, trading as Padgett & Co., 218, Spring Bank, and 10, Beverley Road, Hull, electrical and radio engineers.—The receiving order in this matter was made on August 18th, on debtors' own petition. The statement of affairs shows liabilities of £722, against assets of £189. The first meeting of the creditors was held on September 9th, at the Official Receiver's Office, Hull. The following are creditors:—

	£		£
Barker, R.	33	Metro-Vick Supplies, Ltd. ...	65
Clark, H., & Co. (Manchester), Ltd.	25	Mageris & Co.	95
Dyson, J.	194	Rothermel Radio Corporation of Great Britain	25
Graham, Alfred, & Co.	26	Shenton & Co., Ltd.	33
Humber Oil Co.	43	Webster, S., & Co.	82

H. MILNES (H. Milnes & Son), plumber and electrical engineer, 6, Trinity Street, Huddersfield.—Receiving order made September 11th, on debtor's own petition.

W. H. GREENALL (Hampton Electric Co.), electrician, Newerne Street, Lydney.—Last day for proofs for dividend, September 29th. Trustee, Mr. E. Owen, Official Receiver, 34, Park Place, Cardiff.

G. MASON and G. E. TINSLEY (Mason & Tinsley), electrical engineers, 6, Alberta Terrace, Sherwood Rise, and 94, Upper Parliament Street, Nottingham.—Receiving order made September 15th, on debtor's own petition.

J. F. CARR, electrical goods agent, 89, Aston Avenue, Fallowfield, Manchester.—Last day for proofs for dividend October 2nd. Trustee, Mr. J. G. Gibson, Official Receiver, Byrom Street, Manchester.

J. V. FIGGINS, 97, Fore Street, St. Marychurch, Torquay, trading as Victor Figgins, plumber, electrical engineer, &c.—The first meeting of creditors was held on September 14th at the Official Receiver's office, Exeter. The statement of affairs was referred to in our last issue. The case being a summary one was left in the hands of the Official Receiver as trustee of the estate.

Company Liquidations.—FULLER'S UNITED ELECTRIC WORKS, LTD.—The following are creditors for £50 and over:—

	£
Armstrong, R., & Co., Ltd.	2,663
Allan, Alex., & Co., Ltd.	52
Allied Freight Services	269
Addwater & Sons	201
Allmetal Small Ware Co.	109
Albion Mfg. Co., Ltd.	146
Allen, Edgar, & Co., Ltd.	69
Abel, W. Price	87
British Oxygen Co.	67
Buck & Hickman, Ltd.	131
Bolton, T., & Sons, Ltd.	303
Barking Press	92
British Xylonite Co.	159
British Insulated Cables, Ltd.	64
Burnham & Co.	172
Brimsdown Lead Co.	2,674
Brotchie, C. H. B., & Co.	207
Broadwood, J., & Son	152
Birch, J., & Son, Ltd.	158
Bridgford, J. R.	63
Bertram, J.	67
Barrett, H., & Co., Ltd.	73
Beck, J. A.	63
Baker, R., & Co.	69
Cory, W., & Sons, Ltd.	616
Cookson's Lead Antimony Co.	405
Carter, Paterson & Co.	59
Compagnie Commerciale du Nord, Ltd.	76
C.A.V. Small Tools	129
Cement Marketing Co.	56
Cowell, H.	68
Cubbon, Major	317
Dorman, Long & Co.	449
Darlington Wire Mills	483
Eames Bros.	156
Eastern Telegraph Co.	62
Ebonestos Insulators	96
Espir, F.	1,576
Fuller, L.	109
Fuller, G. A.	78
Fuller, D., and others	212
Farr, Smith & Co.	77
Ferguson, Wild & Co.	85
Fuller's Canteen	142
Foster, Blackett & Wilson	297
Glicksten & Son, Ltd.	90
Goldsmith, C.	188
Groves, J. & B.	120
Gas Light & Coke Co.	154
General Electric Co., Ltd. (London)	93
Gall-y, S. & J.	103
Girdles, J., & Co.	5,397
General Celluloid Co.	1,234
General Electric Co., Ltd. (Birmingham)	175
Goulston, J.	126
General Steam Navigation Co.	243
Griffiths, H., Swansea	50
Glastok Patent Roof Co.	87
Hare & Co.	59
Hobbies, Ltd	68
Hearl, Heaton & Co.	200
Hoyles & Smith	65
Hall, W.	51
Hillbar Press	188
Hardman, Ingham & Dawson, Ltd.	536
Harrison & Rogers, Ltd.	196
Hooker, F. S.	125
I.U.D.C.	1,410
Inland Revenue	6,550
Johnson, R., & Nephew	458
Keeping, R. E.	457
Kemp, A., & Co.	59
Lewis G. Lewis	68
L.M. & S. Railway	248
Muir, Beddall & Co.	379
Moss, J. E.	87
Monometer Mfg. Co.	90
Multipole Winding Co.	289
Midwood, A.	902
Martin, J. W. & D.	901
Mayfield Garage	108
Multiplex Machine Co.	71
Menett, Son & Street	52
McDonald, Dr. J.	104
Merritt, H. C. (and another)	66
North British & Mercantile Insurance Co.	461
Netherland Cable Works	122
North-West Rubber Co.	78
National Bank of Scotland	14,357
Pilkington Bros.	820
Pathe, Hill & Co., Ltd.	460
Page, Calnan & Co., Ltd.	53
Pratt, F. R.	136
Plessey & Co.	432
P.M.G. (Telephones)	9,205
Pruden & Co.	529
Palser, J. F., & Sons	160
Pollard & Smith	348
Provincial Exhibition	56
Quirk, Barton & Co.	88
Ratcliff & Son	471
Rollett & Co.	66
Rubber Regenerating Co.	243
Sawmills, Ltd.	166
Stevenson, Hugh, & Sons	73
Schmurman, J.	194
South Essex Water Works	450
Simonds, T. E.	113
St. Helens Cable & Rubber Co.	351
Sly, Dibble & Co., Ltd.	249
Sellwood Micklewright	89
Salter, G., & Co., Ltd.	56
Spicer Bros., Ltd.	71
Singer, J. W., & Sons	74
Standard Screw Co.	93
Scott & Middleton	137
Shaw, Wardlow & Co.	3,279
Symonds, R. H.	1,923
Smith, J., & Co.	55
Silver Spirit	80
Tomey, J., & Son, Ltd.	271
Thornell, J. (Sydney, N.S.W.)	258
Thompson & Norris Mfg. Co.	67
Topple, W. L.	171
United Alkali Co. (Liverpool)	54
Varley Magnet Co.	160
Vacuum Oil Co.	70
Vickers, Ltd.	53
West Ham Chemical Co.	96
Withers & Spooners	298
Wingfield & Son	54
World Power	64
Wighton T., & Co.	175
Waring & Gillow	159
Wade, F. R.	82
Whinney, Sir A.	83
London Depôt	78
Fully secured creditors	117,370
Partly-secured creditor	808
P. Hill (sec. £525)	

SEAGULL, LTD., radio manufacturers, Regent House, Kingsway, W.C.2.—A meeting of creditors was held on September 16th, at the offices of the company. The liquidator said that it appeared that a company was formed on July 24th, 1921. The business was taken over by the present company in April, 1924, to put on the market a special new three-valve radio set. In 1924 the lease of the premises at Newcastle Place, Edgware Road, was purchased, for the manufacture of those sets, and in the following year it was decided further arrangements should be made for producing sets with from one to four valves. For that purpose additional capital was raised by the directors and their friends. An advertising campaign was decided upon and a great deal of money was spent. Unfortunately, however, due to the very heavy overhead charges, the company made nothing at Newcastle Place with the exception of coils, and owing to the slow delivery of goods which the company ordered it was forced to refuse a number of orders as they could not be completed in time. According to the balance sheet prepared up to February 5th, 1926, there was a loss of approximately £2,000. The liquidator said that he could not produce the balance sheet or a copy of it. The directors had used every means whereby the company might be carried on satisfactorily and the creditors would receive 20s. in the £. From July last none of the directors had received anything by way of salary. Dealing with an approximate statement of affairs which had been prepared, the liquidator said that the total liabilities amounted to £2,386, of which £386 was due to the trade, there was rent due amounting to £33, a bank overdraft of £14, and the balance of £1,953 was due to unsecured loan creditors. The statement showed a deficiency of £1,884. The issued share capital was £1,150, all of which was fully paid up. On August 19th a meeting of the shareholders was held, and the position was fully discussed. Subsequently it was decided that the company should go into voluntary liquidation, and Mr. W. H. B. de M. Leathes was appointed liquidator. The latter stated that he was appointed a director in April last. A creditor inquired why the company went into liquidation; one of the directors replied that it was owing to heavy liabilities. The creditor pointed out that the liabilities were mostly made up by the claims of the directors, and the bank overdraft was very small.

Mr. Robinson said that the loan creditors were anxious to make the best arrangement for the trade creditors, and they had decided, if the creditors were willing, to withdraw their claims, provided they took over the lease of Newcastle Place, together with the tools, plant, fixtures, &c. In that case the creditors would be in possession of the cash at bank, book debts, stock, &c., which if realised satisfactorily should pay them a dividend of something like 15s. in the £. The liquidator had already received offers for a great deal of the stock at approximately 70 per cent. above the cost price.

Mr. Hunter pointed out that if the suggestion was to be passed it would have to be decided between the liquidator and the loan creditors. All the trade creditors could do was to vote in favour of the suggestion. It was eventually decided that the voluntary liquidation of the company should be confirmed with Mr. Leathes as liquidator, together with a committee of inspection consisting of the representative of the Eastern Wireless Co., Ltd., and Mr. C. Latham, of the Wireless and Radio Trades Guardian Association, representing creditors. The creditors intimated that they were in favour of the suggestion which had been put forward by the loan creditors. The following are creditors:—

	£		£
Pirelli, Ltd.	30	Standard Telephones & Cables, Ltd.	30
Brown, S. G.	25		
Eastern Wireless Co.	120	Maples, Ltd.	55

MIDDLESBROUGH STEEL TUBE CONDUIT CO., LTD.—A petition for the winding up of this company has been presented to the County Court of Yorkshire, held at Middlesbrough, by Mr. E. Harenith, export merchant, 39, Longue Rue, Neuve Antwerp, and will be heard at Middlesbrough on September 28th.

INTERNATIONAL RADIO MANUFACTURERS, LTD.—A meeting of members is called for October 18th, at 94, Old Broad Street, E.C., to hear an account of the winding up from the Liquidator, Mr. P. B. Nevill.

ELECTRIC REPAIRS, LTD.—A meeting of members is called for October 18th, at Imperial Buildings, Bridge Street, Walsall, to hear an account of the winding up from the Liquidator, Mr. J. T. Bunch.

RADIO VALVES, LTD.—A meeting of creditors was held at the Liquidator's Offices, 182-3, Temple Chambers, Temple Avenue, E.C., on September 23rd. Particulars of claims to the Liquidator, Mr. W. H. Bevan, by October 31st.

Private Arrangements.—F. A. HARTLEY and R. HARTLEY, trading as F. A. Hartley & Son, 98, Katherine Street, Ashton-under-Lyne, electrical engineers, &c.—A meeting of creditors was held recently, when a statement of affairs was presented which showed liabilities of £683. The assets were estimated to realise £126, leaving a deficiency of £557. With regard to the separate estates of the partners, it was reported that Mr. F. A. Hartley owned a house; the deeds, however, were lodged with the bank as security for an overdraft, and in March last a mortgage was deposited with the bank against the overdraft. Mr. F. A. Hartley also possessed furniture. The business was taken over by the debtors in 1909. The present position was said to be due to bad trade and loss on contracts. Those losses were attributed to the absence, through illness, of Mr. R. Hartley for a year. At that time the firm had several large contracts on hand, and they were carried out without proper supervision. Mr. F. A. Hartley said that the annual turnover had averaged £800 to £1,000 per annum, and the two partners had drawn £4 per week each. In addition, sums had been paid to a lady in respect of goodwill and stock which was taken over at the commencement of the business. Mr. Hartley also said that the sum of £250 was lost on a contract for the installation of electrical fittings in 72 houses belonging to the Ashton-under-Lyne Corporation. No offer was made, and the second largest creditors, Messrs. Gratrix Junior & Bros., Ltd., intimated that they would place a petition on the file for bankruptcy. The meeting therefore broke up without any resolution being passed. The following are creditors:—

	£		£
Baxendale & Co., Ltd.	224	Hartley, Mrs. E.	98
S. Gratrix Junior & Bros., Ltd.	143		

American Lamp Price Reduction.—United States electric lamp manufacturers have recently reduced, for the eighth time since 1920, the prices of their lamps. The price, it is stated, is now 44 per cent. below the pre-war level. The average level of commodity prices in the United States is 65 per cent. above pre-war.

Irish Electrical Imports.—The imports of electrical goods, excluding machinery, into the Irish Free State during July last amounted to £36,993, as compared with £23,358 in the same month in the previous year. The official returns for the first seven months of the year show a total of £258,407, as compared with £182,502 in the corresponding period of 1925.

Aluminium Production in Russia.—A new power station is in course of construction on the western bank of Lake Onega, and is intended to be set in operation next year for the supply of energy for the production of aluminium from the bauxite deposits situated to the south of the new power station.

Norwegian Aluminium.—It is reported from Oslo that the A.S. Haugvik Smelteverk, which is a subsidiary of the British Aluminium Corporation, is in process of formation in London, with a share capital of 3,000,000 kr., of which there will be no public issue. It has been stated that working at the old furnaces at Glomfjord would be resumed this year, but an investigation has shown that it would not be remunerative to do this, and it is therefore not expected that actual production will begin before October, 1927. English experts are expected to arrive at Glomfjord some time this year.

Italian Products for Italy.—It is stated that the Association of Italian Electricity Companies has requested its members to abstain from the purchase of foreign machines, particularly motors and transformers. In the case of low foreign offers being made the Association proposes to pay compensation of at least 5 per cent. in order to render possible the acceptance of Italian offers. This action is said to be directed chiefly against French dumping due to the depreciated franc, and, to a lesser extent, against German interests.

New Zealand Preference.—We quote the following extracts from a leading article published on August 12th by the *Industrial Australian and Mining Standard* under the title "Well Done—New Zealand!":—"Last week the Auckland Electric Power Board placed contracts for its cable requirements, amounting to £125,000, with British manufacturers in face of substantially lower tenders from Germany. The preference accorded to British industry amounted to several thousands sterling, and it is worth noting that the decision of the board evoked a chorus of approval throughout New Zealand. In England, where naturally the news was delightedly received, many of the leading British daily newspapers paid grateful and glowing tributes to the policy of New Zealand. . . . The Auckland Power Board's action in placing its contracts in England instead of in Germany will be warmly approved throughout the Commonwealth. The people of Australia have divided opinions on many subjects, but they are practically of one mind in believing it to be the duty of the nation when purchasing overseas to see to it that none but British firms will get the orders, even though similar goods could be procured from foreign countries at lower prices. . . . Britain needs to-day every atom of preference the Dominions can grant her, and her need is so urgent that she makes no secret of it. . . . We should make it our national business to see that no foreign goods are permitted to enter the Commonwealth unless proof is furnished that such goods are unprocurable in Britain."

Electric Plant Orders.—MESSRS. POWER CONTRACTS, LTD., have been awarded the contracts for the crude oil electric generating plant, power, lighting, cooking and heating installations for Messrs. William Heinemann, Ltd.'s new works at Kingswood, Surrey; also for the electric power and lighting equipment of the extension of the works of the Cornwall Press, Ltd., Paris Garden, Stamford Street, S.E.1.

Australian Contract Developments.—The *Daily Guardian* (Sydney) reports that at a recent meeting of the Sydney City Council serious allegations with regard to the award of a contract for steam-raising plant were made by Alderman Courtenay. He maintained that the manager of a firm tendering for the plant had agreed to pay £15,000 (it was not stated to whom) to secure the contract, which was valued at about £500,000. It was further stated that the London office of the firm in question refused to sanction the arrangement and the manager was forced to resign. Alderman Courtenay read a letter purporting to substantiate the allegations and then produced another which charged an unnamed person with demanding commission from a firm whose tender for motor trucks had been recommended for acceptance, stating that failing payment the order would not be placed. The alderman called for a Royal Commission to investigate the matters, but his proposal was defeated.

Another Sydney contract called into question is that recently awarded to the Commonwealth Shipping Board for the supply and erection of power plant at Botany Bay. The *Herald* (Sydney) says that the Commonwealth of Australia and the Federal Attorney-General have applied for an injunction to restrain the Board from proceeding with the work, on the grounds that it is outside the scope of the Board's powers. The contract is for six turbo-alternators at the price of £666,605, and was secured by the Shipping Board in competition with twelve firms. Parts of the plant were to be made by the Metropolitan-Vickers Electrical Co., Ltd., and its associated Australian company.

Lead.—In their report dated September 18th, Messrs. James Forster & Co. state:—"There is little change to report in the general position. Home consumers, particularly battery manufacturers, are fully employed, but few of them have covered their future requirements, preferring to continue a 'hand to mouth' policy of buying. . . . Unless lead arrives in larger quantities than has been the case during the past month, it is almost certain that a shortage will develop before long. The Board of Trade returns for August show:—Imports 19,863 tons, exports 1,931 tons, leaving for home consumption 17,932 tons."

Book Notices.—"Magnetism and Electricity," by R. W. Hutchinson. 2nd Edition. Pp. viii+630; figs. 407. Price 9s. 6d. "First Course in Wireless," by R. W. Hutchinson. Pp. vii+262; figs. 208. Price 3s. 6d. London: University Tutorial Press, Ltd.

"The Engineering Educator" is the title of a new serial publication edited by Mr. W. J. Kearton, M.Eng., A.M.I.Mech.E., A.M.Inst.N.A., which Messrs. Sir Isaac Pitman and Sons, Ltd., are producing in 30 fortnightly parts, price 1s. 3d. each part; we have received an advance copy of Part I, which will be on sale on October 2nd.

"*Journal* of the Institution of Electrical Engineers." Vol. LXIV. No. 357. September, 1926. London: E. & F. N. Spon, Ltd. Price 10s. 6d.

"History of the States of Guernsey Telephone System, 1895-1925," by A. R. Bennett. Pp. 143; illustrated. London: L. Parsons. Price 5s. net.

"Tungsten: A Treatise on its Metallurgy, Properties, and Applications," by C. J. Smithells. Pp. viii+167; figs. 156. London: Chapman & Hall, Ltd.

Unemployment.—There was a rise of 9,741 in the number of unemployed during the week ended September 6th, the total at that date being 1,559,500, as compared with 1,549,759 on August 30th, and 1,345,455 on September 7th, 1925.

Social Event.—The Liverpool Electric Cable Co., Ltd., held its annual bowling main and picnic at the Swan Hotel, Aughton, on September 4th, the party consisting of about 80, travelling by motor coach. Competition in the main was especially keen for the silver cup presented by the managing director, Mr. W. J. Terry. Mr. T. H. Tweedle, works manager, presented the prizes.

Calendar.—MESSRS. JAMES GORDON & CO., LTD., have issued a handy pocket calendar for the latter half of 1926 and the first half of 1927, advertising their "Rheograph" recorder.

Russian Orders for Germany.—A report from Berlin announces that the Soviet Council of Labour and Defence has decided to proceed with the work of constructing the proposed hydro-electric works on the River Syas, and that a committee is being sent to Germany to place orders for machinery.

New French Company.—La Société Hydro-Electrique des Monts d'Arrée is the name of a new company which has lately been formed at Landvisian (Finistere) with a capital of 3½ million fr., to establish a hydro-electric station on the River Ellez.

The "Lopulco" System.—INTERNATIONAL COMBUSTION, LTD., reports the receipt of a number of important orders for its "Lopulco" pulverised fuel firing system since the beginning of the year. These include an installation for 40,000-kW of plant at the Brimsdown station of the North Metropolitan E.P.S. Co.; the Congella station of the South African Electricity Commission; a new power station at Buenos Aires; the 250,000-kW extension at the Barking Station of the County of London Electric Supply Co., Ltd.; and a number of industrial organisations.

Lighting and Power Notes.

Afghanistan.—JALALABAD.—According to *Indian Engineering* many improvements are being effected in the Amir's administration of Afghanistan. Amongst them is an electric power house which has been ordered to be constructed at Jalalabad. It will be managed by a company.

Blackburn.—WIRING OF SMALL HOUSES.—The Town Council has approved a scheme of assisted wiring for small houses, and application is to be made for sanction to a loan of £15,000 to cover the cost of the scheme.

Bradford.—LOAN SANCTIONED.—The Corporation Electricity Committee has received sanction to the borrowing of £150,000 to meet estimated expenditure on mains and services during the next three years.

NEW TRANSFORMER CHAMBER.—The Committee has decided to install, at a cost of £4,700, a district transformer chamber for the Toller Lane area.

Burnley.—INSTITUTION SUPPLY.—Two new engines at Primrose Bank Poor Law Institution were formally started up on September 16th. It was stated that the engines replaced plant used for 20 years. The cost of the two sets was £1,397. Both are capable of developing 200 h.p., the estimated cost of production per kWh being 1½d. Last year the consumption of electricity at the institution was 80,000 kWh. This is increasing owing to the addition of new plant in various departments.

Carlisle.—EXTENSION OF SUPPLY.—The Town Council has received the consent of the Ministry of Transport to the use of overhead lines in the rural area for the transmission of electricity at a pressure of 11,000 V, to enable a supply to be given to the Cocklakes Works at Cumwhinton. Sanction to a loan of £10,000 for mains and services has been applied for.

Chichester.—LOAN.—The Town Council is applying for sanction to a loan of £7,000 in connection with the supply of electricity to Levant.

Continental.—AUSTRIA.—The Austrian Siemens-Schuckert Co., of Vienna, has recently completed the installation of an overhead 20,000-V transmission line from the Forstasee hydro-electric station on Lake Worther, belonging to the Karinthian Water Power Co., to Klagenfurt. The line, which consists of copper cable of 35 sq. mm. section, is carried on wooden masts erected in groups of four in pyramid fashion. The line, which is 15 miles in length, is carried across another 5,000-V transmission line and also over the telephone wires between Klagenfurt and Lendorf.

FRANCE.—A new hydro-electric station is about to be erected on the River Isère at Villaroger, in the Department of Savoy, by the Société de la Haute Isère.

Doncaster.—ELECTRICITY SUPPLY FOR PITS.—According to *The Times*, five large Doncaster collieries will be served by a new electricity supply scheme. There will be a 22-mile circuit of cables, which will transmit about 45,000,000 kWh annually, at 22,000 V. Each pit will generate its own supply and contribute any surplus to the circuit, which will serve any of the five collieries in the event of a breakdown in any of the individual supplies. The scheme will come into operation in a month's time. The collieries concerned belong to the Doncaster Collieries' Association, and produce 5,000,000 tons of coal annually. The scheme will also serve thousands of miners' houses, a local authority, and works at Doncaster.

Douglas (I. of M.).—ELECTRICITY EXTENSIONS.—At a recent meeting of the Electricity Committee the borough electrical engineer reported that it was essential under present conditions that the Council should proceed with the scheme of extensions, and he submitted a draft report with respect to the provision of the necessary steam plant.

Dover.—LOAN SANCTIONED.—The Town Council has received sanction to a loan of £6,400 for a cable from the Folkestone electricity works.

Edinburgh.—PULVERISED FUEL.—A report by Mr. Seddon, electrical engineer and manager of the Corporation electricity undertaking, on his visits to powdered fuel plants in this country and on the Continent was submitted to the Corporation on Thursday last week. He had formed the opinion that when fuel was supplied to steam boilers in the dry, powdered-fuel state, it provided greater ease of control, and was more efficiently burned than was possible with raw coal burned on mechanical stokers. From information collected, however, and from his own observations, he was satisfied that the plant available for drying and pulverising coal had not reached such an advanced state that it could be considered sufficiently reliable for central-station work. The maintenance of the pulverising mills, fans, pipework, &c., and the difficulty experienced in drying coal with high moisture content, together with the serious nuisance from coal dust and ash grit, had influenced him in recommending that powdered fuel firing should not be adopted for the present extension of boiler plant. He proposed in another report so to arrange the new boiler plant that it would be possible to adopt powdered fuel firing at comparatively small expense, should this be found to be a practicable and reliable proposition, at a later date. The report was adopted by the Corporation.

Irish Free State.—LETTERKENNY (CO. DONEGAL).—At a meeting of the Urban District Council it was reported that three banks had refused an application for a loan in aid of the electricity scheme, with the result that the scheme could not be proceeded with for some time. Approval was given to the action of the clerk in approaching the Free State Government in the hope of securing its assistance towards the furtherance of the scheme.

London.—ST. PANCRAS.—The Electricity and Public Lighting Committee has recommended to the Borough Council that an additional feeding main be laid in Regent's Park Road, and that application be made for sanction to a loan of £5,370 to cover the cost of the work.

ISLINGTON.—The Electricity Committee has received sanction to loans of £22,000 for mains and £3,000 for switchgear.

Mansfield.—BULK SUPPLY.—The *Nottingham Journal* states that, following a report on the experimental bulk supply, the committee concerned has considered the dismantling of the generating plant, and has decided that the steam turbine, together with the necessary plant and storage batteries, shall be retained for use in the event of the supply being interrupted, for a period of twelve months.

Penmaenmawr. — PRICE REDUCTION. — The following reduced charges for electricity have become operative in the area of the Urban District Council. Power: First 500 kWh, 3d. per kWh; next 500 kWh, 2½d.; over 1,000 kWh, 2d.

Portsmouth.—MAINS EXTENSIONS.—The Electricity Committee has authorised mains extensions at a cost of £1,500.

ELECTRICITY IN BULK.—The Borden & District Gas Co. is negotiating with the Corporation for a supply of electricity in bulk. The cost of the necessary overhead lines is estimated at £2,000.

The Electricity Committee has recommended the provision of a bulk supply to Midhurst, the cost involved being £15,000. Messrs. Bailey, Grundy & Barrett, Ltd., have applied for the supply, and state that a company is being formed to supply Midhurst and district.

The Petersfield Electric Light & Power Co., Ltd., is negotiating with the Corporation for a bulk supply, which will necessitate the laying of cables at a cost of £7,000.

Price Increases.—Owing to the higher cost of coal, increases in the charges for electricity have been made or recommended in the following districts:—

COLCHESTER.—Electricity for all purposes: An increase of 10 per cent.

WEYMOUTH.—Lighting: From 7d. to 8d. per kWh. Power: From 2d. to 3d. per kWh.

STOKE NEWINGTON.—Lighting and power: An increase of ¼d. per kWh. Public lighting: An increase of 10 per cent.

CHICHESTER.—An increase of 0 per cent.

YARMOUTH.—An increase of 12½ per cent.

Reigate.—SPECIAL ORDER.—The Rural District Council has consented to an application by Edmundson's Electricity Corporation, Ltd., for a Special Order to extend its area of supply under the Dorking Electric Lighting Order, 1897, so as to include the parishes of Betchworth and Buckland. The Council had previously given consent for the Leatherhead and District Electricity Co., Ltd., to supply the two parishes in question, but it was suggested that the competition might result in better terms being obtained.

Sheffield.—STREET LIGHTING.—A new scheme of electric lighting for central streets in the city is about to be put into operation. The 500-watt lamps now used are to be replaced by 1,000-watt gasfilled lamps. The new lamps are to be fixed 25 ft. high on the brackets of the tramway standards.

Skegness.—ELECTRICITY SCHEME.—The Urban District Council has instructed the surveyor to prepare a scheme for the generation of electricity at the pumping station to supply electricity for the new piazza and pool and illumination for the bathing lake.

Special Orders.—The Harrogate Corporation has applied to the Electricity Commissioners for a Special Order authorising it to extend its area of electricity supply so as to include certain parishes in the rural district of Knaresborough.

The Commissioners have submitted to the Minister of Transport for confirmation a Special Order made by them authorising the Seaham Harbour Urban District Council to supply electricity in its area and in the parish of Seaham.

Swansea.—YEAR'S WORKING.—The accounts of the Corporation electricity undertaking (engineer: Mr. J. W. Burr) for the year ended March 31st last record a total revenue of £189,799, as compared with £192,560, the decrease being attributed to the reductions in the charges for electricity made during the year and the stoppage of the Amman Valley Collieries. The working expenses amounted to £117,821, as against £112,156, leaving a gross profit of £71,978 (£80,404), to which were added miscellaneous items, making a total of £73,524. Against this capital charges, &c., had to be met amounting to £57,190, resulting in a net surplus of £16,333, as against £34,381 in the previous year. A contribution of £5,025 was made to the borough fund. The sale of electrical energy increased by 5.7 per cent.

MAINS EXTENSIONS.—The Electricity Committee has decided to extend the mains, at a cost of £8,000.

Swindon.—NEW ELECTRICITY CHARGE.—The Town Council has decided to supply electricity to houses on the basis of an "all-in" supply at a fixed charge of 15 per cent. on the net rateable value of the premises, plus 1d. per kWh for all electricity consumed.

Tanfield.—ELECTRICITY SUPPLY IMPROVEMENT.—Steps are being taken by the Council to improve the electricity supply in the district, and a report is being prepared by the electrical engineer.

Thirsk.—ELECTRICITY SUPPLY.—The Electrical Distribution of Yorkshire, Ltd., is asking for powers to supply electricity in the area, and the Council has agreed, subject to the exclusion of about one and a-half miles at Boroughbridge, where a Special Order has already been granted to Mr. R. F. Winder.

Torquay.—NEW PLANT.—The Corporation Electricity Committee has decided to install, at a cost of over £20,000, up-to-date coal-handling plant at the electricity works at Newton Abbot.

United States.—HYDRO-ELECTRIC DEVELOPMENT.—According to the *Electrical World*, hydro-electric projects which involve the development of a total of 275,000 h.p., are planned for the Brazos River and its tributaries, according to reports by Mr. A. H. Dunlap, a member of the State Board of Water Engineers. On a number of the sites surveys have been completed, and Mr. Dunlap states that at least three-fourths of the projects will be successfully carried to completion. The plans call for the construction of seven large reservoirs, besides numerous channel dams. The various projects on the main Brazos call for a total development of 228,000 h.p.

The fourth of the five big electric generators that will equip the first section of the new Kearny (N.J.) generating station of the Public Service Electric & Gas Company was put into service on August 20th. It has a capacity of 43,750 kVA, and brings the total present capacity of the station up to 165,900 kVA. The last unit, work on the installation of which is progressing rapidly, will have a capacity of 39,200 kVA, so that the final capacity of this section will be 205,100 kVA. Since January 1st the total generating capacity of the company has been increased by 118,050 kVA, or more than one quarter. New Jersey's industrial and domestic demands are absorbing this increased power almost as fast as it is rendered available.

The first 45,000-h.p. unit at Martin Dam, the Alabama Power Company's new hydro-electric station at Cherokee Bluffs on the Tallapoosa River, was recently put into operation for the purpose of test. The initial test proved satisfactory in every way. The machine will be under test for a number of weeks before final acceptance. Under present plans the three initial units, with a capacity of 135,000 h.p., should be in regular operation by January next. The ultimate capacity of the project when finally completed will be 180,000 h.p.

Wakefield.—LOAN SANCTIONED.—The Electricity Committee has received sanction to a loan of £5,000 for the provision of meters.

Weymouth.—LOAN SANCTIONED.—The Electricity Committee has received sanction to the borrowing of £40,000 for electricity extensions, and has decided to proceed with the scheme immediately.

Willington.—ELECTRICITY SUPPLY.—At a recent meeting of the U.D.C. it was decided to apply for powers to enable the Council to distribute electricity. The Newcastle Electric Supply Co. has powers to light the district ,but it was considered very unlikely that the company would want to exercise its powers. The Council proposes to obtain a bulk supply.

Tramway and Railway Notes.

Continental.—GERMANY.—An express electric tramway, the cost of which has been borne by the respective municipal authorities, has recently been completed and opened for traffic between Dusseldorf and Duisberg, Germany. The line, which is about 17 miles in length, passes through the streets of the two towns, but has its own track in the intervening country, enabling a speed of 30 km. to be attained.

BELGIUM.—The decision of the Belgium Government not to proceed with the construction of a junction line to give a railway connection between the Nord and Midi stations in Brussels, has revived the question of constructing an underground electric railway in the Belgian capital, schemes for which have at different times been drawn up.

ITALY.—Ten electric locomotives of a new type have recently been completed by the Breda Co., of Milan, for use on the Rome-Tivoli-Avezzano railway. The engines, which have a wheel-base of 38 ft., are equipped with two motors, which drive through gearing a countershaft connected to the driving axles by coupling rods. They are designed to be operated by 10,000-V, 3-phase, 45-period a.c., which is stepped down to a working pressure of 1,600 V. The motors are so arranged that either eight or twelve poles may be utilised, and so that they may either be run in series or parallel.

FRANCE.—M. Andre Tardieu, Minister of Public Works, recently made an inspection of the new automatic signals installed on the State railway between Paris Invalides and Meudon, and between the stations of Vallées and Rueil. The system is luminous both by day and night, and each signal is composed of a board carrying six, eight, or ten red, green, or white lamps. The approximate cost of the scheme was 215,000 fr. per km.

London.—EXTENSION OF UNDERGROUND SERVICE.—*The Times* reports that the Metropolitan Railway has brought into operation an augmented train service. The company's full schedule of trains, with few exceptions, has been restored, and trains have been retimed to suit the convenience of passengers. The Watford route is being maintained by 90 trains daily, and over the Circle, Hammersmith-New Cross and Great Northern and City sections a full business service is being run.

Oldham.—RAILLESS-CAR SERVICE DISCONTINUED.—According to the *Electric Railway and Tramway Journal*, the through running between Ashton-under-Lyne and Oldham of railless cars has now come to an end. Ashton Corporation continues to run the 'buses to the boundary of Oldham, but Oldham Corporation has reverted to the electric tramcars, supplemented by motor-'buses. It was stated at the Ashton-under-Lyne Town Council meeting that Ashton had made unsuccessful efforts to get Oldham to reconsider its decision. The latter authority states that the experiment, which had been in operation for twelve months, had not been the success anticipated, though the failure was not entirely due to the system, but rather to complaints from residents along the line of route. The heavy type of vehicle in use, it was stated, caused considerable vibration and damage to property.

Uruguay.—RAILWAY ELECTRIFICATION.—An agreement between the State railways of the Banda Oriental (Uruguay) and a firm of contractors provides for the electrification of the line between Belveder and Santiago Vasquez, a favourite resort at the bar of the Santa Lucía River.—*Reuter's Trade Service* (Montevideo).

Telegraph and Telephone Notes.

Turkey.—TELEPHONE SERVICE.—A telephone service with an automatic exchange was inaugurated at Angora on September 11th.—*Reuter* (Constantinople).

Australia.—TELEPHONE SERVICE.—The annual report by the Director of Postal Services (Mr. H. P. Brown) indicates that the department is rapidly overtaking the balance of supply and demand. For the year ended June 30th, 1926, the average decrease of outstanding services was 20 per cent. New applications for the whole of the Commonwealth were 61,015, against 59,480 during the previous year. At the commencement of the financial year there were 892 outstanding services between 6 and 12 months old, which have been reduced to 417, while the number over 12 months old has dropped to 82 from 275. The majority are in rural districts. At the end of the previous financial year, totals of 961 pole miles and 25,707 wire miles were carried over, but this year the outstanding mileage carried forward has been reduced to 710 pole miles and 11,120 wire miles. Victoria exceeded the previous year's output in wire miles by approximately 130 per cent. During the whole year the total mileage of all the combined telephone and telegraph lines erected was 46,299. The result has been an increase in telephone revenue of £41,298, and in telegraph income of £4,125.

France.—AUTOGRAPHIC TELEGRAMS.—An autographic telegram office on the Belin system has been opened at Marseilles, which town will now be able to communicate by "belinogram" with Nice, Paris, Lyons, and Mulhausen, where similar offices exist.—*Reuter's Trade Service* (Marseilles).

Finland.—TELEPHONE CONSTRUCTION.—According to *Commerce Reports*, approximately $61,100 was spent last year in Finland on the construction of new telephone lines for the Government-owned system. About 684 miles of double-wire lines were installed and 62 miles of single wire. A little over 100 miles was added by the installation of a phantom circuit with two iron-wire lines. Considerable progress was made in the installation of automatic telephones in Helsingfors which will ultimately have only automatic apparatus.

Sierra Leone.—TELEGRAPH AND TELEPHONE SERVICES.—The annual report for 1925 on the Sierra Leone (West Africa) railway includes an account of the operation during the year of the telegraph system of the country and the telephone exchange in Freetown, both of which are under the management of the railway. The total mileage of telegraph and telephone lines at the end of the year was 1,244, an increase of 40 miles as compared with the preceding year, due to the extension of telephone lines in Freetown. Reconstruction of the Songo-Port Lokko line was completed during the year, and work on the rewiring of a number of stations commenced. Excluding messages on railway service, the number of telegrams dispatched during the year by the public increased by 7,225 to 52,431, and Government messages decreased by 1,210 to 17,089. The number of electric train-staff instruments was 78, the number of telegraph instruments was 43, and the number of telephone circuits on the Freetown exchange was 97, or nine more than in 1924. The number of subscribers, excluding the railway, connected to the telephone exchange was 34 public and 17 Government. The revenue from the telegraph service decreased by £235 to £5,265, and the income from the telephone system increased from £1,334 to £1,440. The European telegraph section, which had been under the supervision of an African telegraph inspector, was taken over by Mr. G. Cresswell, of the Nigerian Posts and Telegraphs Department in March, 1925.

Radio Notes.

Canada.—RADIO APPARATUS PRODUCTION.—The production of radio apparatus in Canada during 1925 reached a total value of $5,548,659.

LICENCES.—The number of licences issued during 1925 was 134,486.

Japan.—NEW STATIONS.—*Commerce Reports* states that the Government has appropriated 525,187 yen for the construction of radio stations at the following towns:—Taihoku, Tamsui, Giran, Taito, Karenko, and Itabashi, work on some of which is about to begin. The Bureau of Communications and Transportation of the Taiwan Government General has charge of all matters connected with radio installations and operations, excepting such as are under the control of the Imperial Navy. The apparatus used in home installations in this district is almost exclusively of American make.

Lithuania.—BROADCASTING.—*Reuter's* Trade Service learns that the Kaunas wireless station is trying to place its working on such a footing that it will cost the Treasury less. To that end a measure is being prepared for the introduction of a wireless monopoly in Lithuania, *i.e.*, the Government organs themselves will undertake to popularise broadcasting, to supply subscribers with the necessary apparatus, &c. It is proposed even to manufacture wireless apparatus in Lithuania and to import wireless parts from abroad, though wireless experts declare that a wireless industry is impossible at present in Lithuania. Generally speaking, it is intended to organise wireless in Lithuania on the model of Latvia, whither M. Jurkis, superintendent of the Kaunas wireless station, is going to study the wireless situation there. The exchange of private wireless telegrams with foreign stations is in the experimental stage; private telegrams are transmitted by both the Morse and Hughes apparatus. The Lithuanian wireless station will be registered at the International Wireless Bureau and begin officially to operate only when a proper daily programme has been fixed. In the meantime material for programmes is being collected. A chamber installed with microphones suitable for speeches and music has recently been arranged.

Contracts Open and Closed.

(The date given in parentheses at the end of the paragraph indicates the issue of the "Electrical Review" in which the "Official Notice" appeared in our advertisement pages.)

Open.

Australia.—MELBOURNE.—October 20th. Victorian Government Railways. Rail motor equipment. (A.X. 3449.)*

October 5th. Postmaster-General's Department. Switchboard cords. (B.X. 2747.)*

October 12th. Automatic exchange equipment.

October 26th. Telephone plugs and sleeves. (B.X. 2799.)*

November 9th. Telephone transformers. (B.X. 2797.)* Telephone protective apparatus. (B.X. 2840.)*

SYDNEY.—October 18th. Municipal Council. Two 100-ton electrical overhead travelling cranes. (A.X. 3467.)*

November 1st. Boiler feed pumps for Bunnerong power station. (A.X. 3470.)*

November 15th. 33,000-V cable and pilot cable. (Spec. 1,047. (B.X. 2882.)*

November 29th. Circulating water screens. (Specification 1,014.) Specifications from Constructional Engineer, Electricity Department, Town Hall, Sydney.

Barnes.—October 12th. Electricity Department. One 40,000-lb. water-tube boiler, coal- and ash-handling plant, steel-plate chimney, bunkers, &c. (See this issue.)

Barry.—October 25th. Gas, Water, and Electricity Department. Underground mains, sub-station transformers, and meters. (See this issue.)

Cheadle and Gatley.—September 29th. U.D.C. Electricity Department. E.h.p., m. and l.p. switchgear; transformer switch and distributing kiosk; ironclad switch unit. Specifications and forms of tender from Mr. R. W. Willis, electrical engineer and manager, 37, High Street, Cheadle.

Dublin.—October 18th. Electricity Supply Department. Four water-tube boilers, stokers, economisers, feed pumps and accessories, necessary buildings, foundations, &c. (September 10th.)

5,000-kW generating set complete. (September 17th.)

Edinburgh.—October 18th. Electricity Supply Department. Two motor-driven circulating-water pumps, drainage pump, valves and pipework. (September 17th.)

Midlothian and Peebles District Asylum, Rosslynlee. Stores, including electric fittings, &c. Forms of tender from Mr. C. L. Addison-Smith, clerk and treasurer, 19, Heriot Row, Edinburgh.

Egypt.—CAIRO.—January 1st. Director-General, Mechanical Department, P.W.M. Supply and erection at the site of the Seru pumping and power station of four internal-combustion Diesel alternator groups, three pumps and accessories. Chief Inspecting Engineer in London, Queen Anne's Chambers, Broadway, Westminster, S.W.1. Supply of telegraph and telephone materials, at a cost of between £E.26,000 and £E28,000.

Public Works Department. One d.c. generator and one internal-combustion engine for Helwan-les-Baino electric power station. (B.X. 2883.)*

Hull.—October 5th. Electricity Department. One 20-ton electrical overhead travelling crane. (September 17th.)

India.—October 16th. India Stores Department. Four electrically-driven horizontal centrifugal or turbine pumping sets, with transformers. (A.X. 3590.)*

Kilmarnock.—Ayrshire County Council. Electric lighting installation for 16 houses at Mauchline. Mr. D. R. Sturrock, district clerk, Kilmarnock.

Liverpool.—October 5th. City Engineering Department. Two complete sets of pneumatic crude sewage ejectors and electrically-driven air compressors. Forms of tender from the City Engineer, Municipal Buildings, Dale Street, Liverpool.

Manchester.—October 8th. Electricity Department. Two 25 000-kVA and one 1,250-kVA, 3-phase transformers and one 100-ton electrically-operated crane. (September 10th.)

October 12th. Tramways Committee. Permanent way special track work. Specifications and forms of tender from Mr. H. Mattinson, general manager and chief engineer, Corporation Tramways, 55, Piccadilly.

Mexborough.—September 28th. U.D.C. Wiring of 44 houses. Specifications obtainable from Mr. F. E. Hall, clerk to Council, Station Road.

Newtownards (Ulster).—The Board of Guardians is inviting estimates for installing electric lighting at Portaferry Dispensary.

New Zealand.—CHRISTCHURCH.—October 19th. Christchurch Drainage Board. Three sets of electric centrifugal pumping plant. (A.X. 3215.)*

WELLINGTON.—November 2nd. Public Works Department. Electric generators and turbines. (B.X. 2622.) Indoor control gear and switchgear. (B.X. 2675.) 110,000-V transformer for Waikaremoana power scheme. (B.X. 2744.)*

October 5th. One four-motor overhead travelling crane and runway. (A.X. 3517.)*

November 23rd. Lightning arresters and transformers. (B.X. 2792.)*

January 4th. Switchgear and transformers for the Waikaremoana electric power scheme. (B.X. 2872.)*

November 30th. 110-kV transformers. (B.X. 2874.)*

December 10th. Government Railways. Electric motors. (B.X. 2861.)*

November 8th. Post and Telegraph Department. Diaphragms, cords, &c. (B.X. 2860.)

NEW PLYMOUTH.—October 16th. Harbour Board. One 30-cwt. portal electric jib crane, &c. (A.X. 3458.)

AUCKLAND.—October 4th. Electric Power Board. Pole oil switches. (B.X. 2795.)*

October 11th. Ironclad switchgear and single-phase transformers. (B.X. 2793.)*

September 28th. 22,000-V, 3-core armoured cable, pilot cable, joint boxes and dividing boxes. (September 10th.)

INVERCARGILL.—December 1st. Southland Electric Power Board. One 3,200-h.p. horizontal Francis turbine and one 2,350-kW generator. (B.X. 2822.)*

Portsmouth.—September 29th. Board of Guardians. Electrical stores and lamps required during the three months commencing October 1st, 1926. Particulars and forms of tender from Mr. H. C. Morrell, clerk to Guardians, St. Michael's Road.

October 1st. Tramways Department. Stores for 12 months, including insulating materials, lamps, overhead line materials, &c. (September 10th.)

Pudsey.—October 5th. Electricity Department. L.p. cables (approx. 4 miles), joint boxes, feeder pillars, &c. (September 17th.)

South Africa.—PRETORIA.—October 7th. Municipal Council. Transformer and switchgear for the abattoir sub-station. (B.X. 2851.)*

Uruguay.—MONTEVIDEO.—State Electricity Supply Works. Diesel electric generating sets. (B.X. 2865.)*

Whitby.—U.D.C. Construction and management of a cliff tramway on West Cliff. Particulars from V. Seaton Gray, clerk to Council, 38, Flowergate, Whitby.

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

Closed.

Aberdeen.—Education Authority. Accepted:—

Electrical work at new school, Torry (£601).—Andrew McRobb; and at new gymnasia (£41 and £39).—John Wurling.

Australia.—SYDNEY.—With further reference to our note on page 468 (ELEC. REV., September 17th), at a special meeting the City Council reaffirmed its previous decision to place an order for electric lamps, at £4,581, with Messrs. Segur and Co., Ltd., for the supply of Condor lamps, made in Holland.

City Council. Accepted:—

10,000 lb. bare copper cable (£554).—W. Adams & Co., Ltd.

8,500 positive plates, 500 negative, and 100 half negative, 17,500 wood-board separators, 35,000 wood side rods, 52,500 centre rods for the Phillip Street sub-station battery (£41,281).—Tudor Accumulator Co., Ltd. (The amount quoted includes £9,272 duty.)

33,000-V cast-iron joint boxes (£12,140).—C. J. Waddell.

L.p. switchgear and spares, &c., for sub-stations (£8,666).—Godfrey, Ltd.

New South Wales Railways.

One 10-ton electric overhead travelling crane (£1,775).—Gibson, Battle and Co., Ltd.

New South Wales Public Works Department. Kembla power station plant:—

Two steam boilers, automatic stokers, superheaters, economisers, &c. (£14,582).—Babcock & Wilcox, Ltd.

3,000-kW turbo-generator, with Briton, Ltd., condenser (£14,172).—Bellis and Morcom, Ltd.

Eight 15,000-kW rotary converters, switchgear, and transformers for Strathfield and Lewisham sub-stations (£44,004).—Australian General Electric Co., Ltd.

MELBOURNE.—City Council. Accepted:—

A.c. two wire meters (£3,371).—Lascelles, Parrington, Ltd.

26,810 yd. insulated copper cables (£14,961).—Metropolitan-Vickers Electrical Co., Ltd.

Three 6,000-kW, 3-phase reactors (£1,161) and one a.c. control panel (£110).—Australian General Electric Co., Ltd.

Victorian State Electricity Commissioners.

Turbo-generator units for installation in the six power houses, for the Sugarloaf-Rubicon hydro-electric scheme (£81,454).—Boving & Co.

70,000-V transformers (£22,094).—Brown, Boveri, Ltd.

Switchgear in the Rubicon "A" control station (£17,042).—Metropolitan-Vickers Electrical Co., Ltd.

Automatic switchgear for installation in the other sub-stations in the group (£28,675).—General Electric Co. of America.

—*Tenders.*

Barnes. — Electricity (Extensions) Committee. Accepted:—

One 3,000-kW alternator.—English Electric Co., Ltd. (Twenty tenders were received.)

Dumfries.—Dumfries and Galloway Joint Sanatorium Board. Accepted :—

Electric power cables and lighting (£904).—A. Baird & Sons, Ltd.
Boiler-house and power-station equipment (£2,526).—J. Kilpatrick & Sons, Ltd.

Edinburgh.—Electricity Department. Accepted:—

Boilers at Portobello generating station (£8,600).—Stirling Boiler Co., Ltd.

Epsom.—Council School managers. Accepted:—

Installing electric lighting at Hook Road schools (£226).—Goodship and Saunders.

Government Contracts.—The following Government contracts were placed during August 1926 :—

ADMIRALTY, CONTRACT AND PURCHASE DEPARTMENT.

Boiler-feed apparatus.—A. G. Mumford, Ltd.
Electric cables.—British Insulated Cables, Ltd.; General Electric Co., Ltd.; Anchor Cable Co., Ltd ; Siemens Bros. & Co., Ltd.; Hooper's Telegraph and India Rubber Works, Ltd.; Johnson & Phillips, Ltd.; Enfield Cable Works, Ltd.; Hackbridge Cable Co., Ltd.; W. T. Glover & Co Ltd.
Electric cells.—Chloride Electrical Storage Co., Ltd.; D.P. Battery Co. Ltd.
Air Compressor.—G. & J. Weir, Ltd.
Electrically-driven jib crane.—T. Broadbent & Sons, Ltd.
Electric lighting installation.—G. E. Taylor & Co.
Ventilating fans.—Electromotors, Ltd.; Newtons Dynamo Works; Jas. Keith & Blackman Co., Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd.; Siemens & English Electric Lamp Co., Ltd.; Edison Swan Electric Co., Ltd.; Metro-Vick Supplies, Ltd.; General Electric Co., Ltd.
Fuse panels.—General Electric Co., Ltd.
Switch panels.—Bertram Thomas.
Fuel oil pumping and electric generating plant.—W. H. Allen, Sons and Co., Ltd.
Charging switchboards.—Whipp & Bourne, Ltd.
Watertight switches.—General Electric Co., Ltd.
Electrical thermometer apparatus.—Foster Instrument Co., Ltd.
Overhead electric traveller.—Cowans, Sheldon & Co., Ltd.
Valve holders.—H. W. Sullivan, Ltd.
Wireless valves.—Mullard Radio Valve Co., Ltd.

WAR OFFICE.

Inert batteries.—Siemens Bros. & Co., Ltd.
Secondary batteries.—Pritchett & Gold & E.P.S. Co., Ltd.
Submarine cable.—Standard Telephones & Cables, Ltd.
Battery cases.—Barrow, Hepburn & Gale, Ltd.
Lamp cases.—C. F. Timbers.

AIR MINISTRY.

Underground mains (Halton).—Malcolm & Allan, Ltd.
Mains, earth and grid condensers.—H. W. Sullivan, Ltd.
Magneto spares.—British Thomson-Houston Co., Ltd.
Telephone-telegraph W/T installation.—Marconi's Wireless Telegraph Co., Ltd.
W/T valves.—General Electric Co.

POST OFFICE.

Telephone apparatus.—Automatic Telephone Mfg. Co., Ltd.; Hall Telephone Accessories, Ltd.; Peel-Conner Telephone Works; Phœnix Telephone & Electric Works, Ltd.; Standard Telephones & Cables, Ltd.
Testing, protective and miscellaneous apparatus.—Phœnix Telephone and Electrical Works, Ltd.; Standard Telephones & Cables, Ltd.; M. W. Woods.
Battery stores.—Accumulators of Woking, Ltd.; Chloride Electrical Storage Co., Ltd.; Hart Accumulator Co., Ltd.
Service boxes.—General Electric Co., Ltd.
Cable (various).—Connollys (Blackley), Ltd.; W. T. Glover & Co., Ltd.; W. T. Henley's Telegraph Works, Ltd.; Johnson & Phillips, Ltd.; Pirelli-General Cable Works, Ltd.; Siemens Bros. & Co., Ltd.; Union Cable Co., Ltd.
Joint box castings.—General Foundry & Engineering Co., Ltd.; McDowall, Stevens & Co., Ltd.; United Steel Cos., Ltd. (Thos. Batten & Co.).
Loading coils.—General Electric Co., Ltd.
Telephone cords.—British Insulated Cables, Ltd.; Electric Wire Co. and Smiths, Ltd.; Reliance Electrical Wire Co.; Siemens Bros. & Co., Ltd.
Telegraphic ironwork.—Bayliss, Jones & Bayliss, Ltd.
Electric lamps.—British Thomson-Houston Co., Ltd; Cryselco, Ltd.; Edison Swan Electric Co., Ltd.; General Electric Co., Ltd.; Metro-Vick Supplies, Ltd.; Siemens and English Electric Lamp Co., Ltd.
Copper wire.—Whitecross Co., Ltd.
Manufacture, supply, drawing-in and jointing cable.—Birmingham-Redditch-Evesham; Standard Telephones & Cables, Ltd.
Telephone exchange equipment.—Rowe Bros. & Co., Ltd. (Liverpool); Rylands Bros., Ltd. (Warrington); Hampton & Sons, Ltd. (S.W.1); E. & R. Garrould (W.2); Beswick Co-operative Society, Ltd. (Manchester); Equitable Trust Co., of New York (E.C.2); John Gardner (E.C.3); Leyland & Birmingham Rubber Co., Ltd. (Preston); Blackley Co-operative Society, Ltd.; Calico Printers' Association, Ltd. (Manchester); Relay Automatic Telephone Co., Ltd. Colwyn Bay; Llandudno: Siemens Bros. & Co., Ltd.; sub-contractors, Hart Accumulator Co., Ltd., for batteries; English Electric Co., Ltd., for charging machines. Crompton & Co., Ltd., for ringing machines. Old Colwyn; Llandudno Junction; Penrhynside: Siemens Bros. & Co., Ltd.; sub-contractors, Small Electric Motors for dynamotor. Leeds Trunk: Siemens Bros. & Co., Ltd. Monument: Automatic Telephone Manufacturing Co., Ltd.; sub-contractors, Chloride Electrical Storage Co., Ltd., for batteries; Newton Bros. (Derby), Ltd., for machines. Merstham (Surrey): Automatic Telephone Manufacturing Co., Ltd. Wallington (Surrey): General Electric Co., Ltd.; sub-contractors, D. P. Battery Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Belfast relief: Standard Telephones & Cables, Ltd.; sub-contractors, Chloride Electrical Storage Co., Ltd., for batteries; Crompton & Co., Ltd., for machines. Norwich: Standard Telephones and Cables, Ltd., 4-wire telephone repeater station equipment. Leeds: Standard Telephones & Cables, Ltd., lattice steel masts for wireless station: Portishead, C. F. Elwell.

CROWN AGENTS FOR THE COLONIES.

Battery materials.—Siemens Bros. & Co., Ltd.
Cables.—Brown, Lennox & Co., Ltd.
Overhead line material.—Callender's Cable & Construction Co., Ltd.
Switchgear.—British Thomson-Houston Co., Ltd.
Telegraph poles.—J. Spencer, Ltd.
Telephones.—Ericsson Telephones, Ltd.
Train lighting spares.—J. Stone & Co., Ltd.; Chloride Electrical Storage Co., Ltd.
Transformers.—Brush Electrical Engineering Co., Ltd.
Wire.—British Insulated Cables, Ltd.; R. Johnson, Clapham & Morris.

H.M. OFFICE OF WORKS.

Transformers.—National Physical Laboratory, Teddington; Ferranti, Ltd.

Lichfield.—Town Council. Accepted:—

Installing electric lighting at the Free Library and Museum (£53); Guildhall premises and the Municipal Offices (£208); and at the Art Schools (£36).—John Richards & Co.

London.—LEWISHAM.—General Purposes Committee. Recommended :—

Electric lift at Town Hall (£340).—Medway Safety Lift Co.

AIR MINISTRY.—

Accumulators and spare cells.—Edison Swan Electric Co., Ltd.

GENERAL POST OFFICE.—

60,000 switchboard lamps.—Edison Swan Electric Co., Ltd.

BERMONDSEY.—**Baths Committee.** Accepted :—

Electrical installation at new baths in Grange Road (£2,046).—Borough Electrical Engineer's Department.

Manchester.—Corporation Electricity Department.

10-ton 6-wheel electric vehicle, fitted with electrically-driven winches, mains for cable haulage, &c.—General Vehicle Co., Ltd.

Newport (Mon.).—Tramways Committee. Accepted :—

100 tons tram rails (£1,077).—Bolckow, Vaughan & Co., Ltd.

New Zealand. — AUCKLAND. — According to the *Sydney Morning Herald*, the Auckland Electric Power Board, in adherence to its policy of preference for British goods, has accepted the tenders of the Concordia Electric Wire Co. for cable at £11,700 and £6,600, against £7,810 and £4,750 quoted by Messrs. Felten & Guilleaume for German cable. In both cases the German firm's was the lowest tender, the difference between its tenders and the lowest British offers being £5,740, or £4,484 when the duty on German goods was taken into account. The German firm, Felten & Guilleaume, quoted £7,810 for the supply of one class of cable, as against £11,700 by the Concordia Electric Wire Co. For another class of cable the price quoted by the same German firm was £4,750, as against £6,600 by the Concordia Co., which was the lowest British quotation in each case. The Board's manager recommended that the lowest British tender be accepted in accordance with the Board's policy of giving preference to British firms. The chairman's motion to accept the lowest British tender was carried.

Paisley.—Bradford Dyers' Association (Adams, Hamilton and Sons, Ltd., Branch). Accepted :—

1 steam accumulator, 20,000 lb. steam storage capacity, complete with automatic valves.—Fairfield-Howden Ruths Steam Accumulators, Ltd.

Forthcoming Events.

Institution of Fuel Economy Engineers.—Friday, September 24th. At the Royal Society of Arts, John Street, Adelphi, W.C. At 6 p.m. Lecture on "Liquid Fuels," by Dr. A. E. Dunstan.

Birmingham Electric Club.—Friday, September 24th. At the Grand Hotel. At 7 p.m. Lecture on "Breaking Electric Circuits," by Mr. J. Anderson.

Electrical Power Engineers' Association (Southern Division).—Friday, October 1st. At the E.L.M.A. Lighting Service Bureau, 15, Savoy Street, W.C. At 7 p.m. Lecture on "Some Principles of Electric Illumination," by Mr. W. J. Jones.
Saturday, October 2nd. At the Hotel Cecil, Strand, W.C. At 5.30 p.m. for 6 p.m. Annual dinner.

Faraday Society.—Friday, October 1st. At Burlington House, Piccadilly, W. From 2.30 to 4.30 p.m. and from 5 to 6.30 p.m. General discussion on "Physical Phenomena at Interfaces, with Special Reference to Molecular Orientation."

Junior Institution of Engineers.—Friday, October 1st. At 39, Victoria Street, S.W. At 7.30 p.m. Paper on "Notes on Transformer Testing and Test Plant Requirements," by Mr. L. Smith.

The "Electrical Review" Service Department.

INQUIRIES must be accompanied by a stamped addressed envelope.

We should be glad to learn the names and addresses of makers of the following :—

A fuse stamped with the letters W and V interlaced.
GRIMSHAW'S black sticky tape.
GLAMAT lamp protector outfit stamp.
Magnesia composition tubes for fuses.
Inner globes for Jandus Type P arc lamps.

Notes.

An Austrian Electrical Development Association.—An association has recently been formed in Vienna to encourage the use of electrical appliances in Austrian households.

Birmingham Electric Club.—The following programme of lectures has been arranged for the half-session, 1926 :—September 24th, lecture on "Breaking Electric Circuits," by Mr. J. Anderson, M.I.E.E. October 15th, lecture on "Radio," illustrated with lantern slides, by Mr. J. Entwistle. November 12th, paper on "Electric Tramways," with lantern slides, by Mr. A. C. Baker. December 17th, annual meeting.

Educational.—UNIVERSITY OF MANCHESTER, FACULTY OF TECHNOLOGY.—We have received the Prospectus of University Courses in the Municipal College of Technology for the session 1926-27, which opens on Thursday, October 7th. Professor Miles Walker, M.A., D.Sc., M.I.E.E., is chief of the Electrical Engineering Department.

E.A.W. Programme.—We have received a copy of the London fixtures of the autumn programme of the Electrical Association for Women. In addition to lectures by Mr. W. C. Jeary and Miss M. Partridge, B.Sc., on "The ABC of Electric Lighting" and "A Talk on Tariffs," respectively, the following visits are included in the programme: To the all-electric farm of Mr. Borlase Matthews at East Grinstead, the works of the London Electric Wire Co. and Smith's, Ltd., Leyton, E., the Coliseum, St. Martin's Lane, W.C.2 (stage lighting), the Good Housekeeping Institute, 49, Wellington Street, W.C.2, and Electric House, High Street, Croydon.

A Power Conference at Rome.—A conference is being held at Rome this week, from September 21st to 25th, by the Union Internationale des Producteurs et Distributeurs d'Energie Electrique, whose headquarters are at 25, Rue de la Pépinière, Paris. Among the subjects to be discussed are the use of pulverised coal, the employment of high pressures, the gasification of fuel, underground cables, the situation regarding hydro-electric production, legislation, telecommunication, and applications of electricity. Our special correspondent writes:—If one can judge by the social programme, the civic authorities of Rome, the directors of a number of Italian electrical power companies, and many men of note in the world of electricity have arranged to show their hospitality in a way that will doubtless make a lasting impression on visitors from other lands who are attending the conference. The industrial progress of Italy since the unification 50 years ago has been amazing, and in matters connected with electricity the country that gave Leonardo da Vinci and Volta to the world has been a pioneer in many directions; in fact, Italian electrical power companies are using to-day apparatus of a size and type which challenge the productions of other countries. It is a pity, therefore, that Italian engineers do not more often present papers before British engineering societies, and give us the benefit of their skill and experience.

Electricity in the Home.—Some 240 members of the Annfield Plain Co-operative Women's Guild recently enjoyed a lecture on the above subject given by Mr. H. Adam, electrical engineer and manager to the Annfield Plain Urban District Council. In contending that electricity was the best illuminant, he said that out of little more than 3,000 inhabitants in the U.D.C. area, the electricity department had obtained more than 2,000 consumers in less than six years. Mr. Adam informs us that he is about to "push" electricity for other domestic uses than lighting; thereby making the service cables into the consumers' premises work a larger number of hours per day, thus justifying their existence.

The All-Electric Houses of the Woolwich Borough Council.—During recent weeks an agitation has been promoted amongst the tenants of the Woolwich Borough Council on the Eltham Housing Estate, on the ground that electric cooking in these houses is "compulsory," and is unduly expensive and inefficient. The following notes regarding the history of the matter will be of interest:—

In March, 1920, the Council decided to erect houses in Eltham, under the Housing Scheme of the Ministry of Health. Being the owner of an electricity undertaking, it proposed to light these houses by means of electricity, but the South Metropolitan Gas Company was approached with a view to obtaining a supply of gas on the estate for cooking purposes. The Gas Company replied that it would supply gas on the estate—provided that the Council paid a sum of £15 per house to cover the cost of pipes, &c.

The first lot of houses which the Council erected adjoined the main road—Eltham Road, Lee—and these houses were within the statutory distance prescribed by the Gas Order, under which the Gas Company was compelled to lay the usual gas services. The Gas Company, however, applied to the Board of Trade, under the powers provided under Sec. 29, Electric Lighting Act, 1882, for relief from its obligation in this particular instance, in view of the fact that it considered the supply of gas to be unremunerative.

At the same time, the Gas Company laid a Bill before Parliament for the alteration of the method of charging for the supply of gas, and in this Bill a clause was inserted similar to the special application for relief made by the Gas Company. The Borough Council opposed the Bill, and the Board of Trade refused the Gas Company's application for relief in view of the fact that the same matter was included in a Bill before Parliament.

In the end, the Borough Council agreed to waive its objection to the passing of the Bill, which was of considerable importance to gas undertakings in general, provided that the obnoxious clause was excised. The Gas Company agreed to this arrangement; the clause was omitted, and the Bill was passed.

In the meantime, the houses were being erected, and seeing that the Gas Company required a premium of £15 per house, and had refused to supply gas conditionally, the Borough Council decided to do without gas entirely, and to use coal and electricity for cooking purposes.

In 1921, 197 houses were erected; in 1922, 103; in 1923, 110; in 1924, 94; in 1925, 131, and up to January, 1926, 8 more, making in all 643 houses completed up to January, 1926. In all these houses an efficient coal stove is fitted, with an oven and a hot-water boiler, as well as a coal-fired copper, and an electric cooker, as an auxiliary means of cooking. The tariff, at first 2½d., was reduced to 2d., for lighting, heating, and cooking, with prepayment meters; this price was arrived at by estimating the probable consumptions for lighting and other purposes respectively in a normal household. However, it was found to be too favourable to those who used electricity for lighting only, whilst those who adopted electric cooking and heating extensively paid more than their due share. Consequently, the Council decided to adopt a two-part tariff, the fixed charge being based on the wattage of lamps installed in living rooms, and the running charge being ½d. per kWh. This tariff was to come into force on September 29th, but owing to the high price of imported coal its introduction is likely to be delayed pending the settlement of the coal dispute. Prepayment meters embodying the two-part tariff principle will be employed, it being essential in connection with the Housing Estate to employ the system of payment in advance.

Appointments Vacant.—Meter tester and repairer (£4/5+) for the Works and Buildings Department, Air Ministry, Iraq. Electrician for the Electricity Distribution of North Wales and District, Ltd. Plumber-jointer for the Hazel Grove and Bramhall U.D.C. Electricity Department. (See our advertisement pages to-day.)

A New Circuit Breaker.—In our last issue, page 479, the name of the makers of the device described under the above heading was given as Messrs. J. G. Slater & Co. This is incorrect, and should read Messrs. J. G. Slatter & Co.

Glasgow Electricity Supply.—Invitations have been issued in connection with the official opening of the second section of the Dalmarnock power station of the Glasgow Corporation. The ceremony, which will take place on September 30th, will be performed by the Lord Provost, Sir Matthew Montgomery. A luncheon in the City Chambers will follow. Sir James Kemnal, of Messrs. Babcock & Wilcox, will propose the toast of "The Electricity Committee," and ex-Bailie Dewar, the Convener, will respond. Among the other speakers will be Mr. W. W. Lackie, late chief engineer and manager of the department, and now one of the Electricity Commissioners, who will propose the health of his successor in Glasgow, Mr. R. B. Mitchell.

Institution Notes.

Institution of Electrical Engineers.—The dates of meetings up to the end of 1926 are as follows:—

Ordinary meetings (Thursdays): October 21st; November 4th, 18th; December 2nd, 16th.

Wireless Section meetings (Wednesdays): November 3rd; December 1st.

Informal meetings (Mondays): October 25th; November 8th, 22nd; December 6th.

The annual dinner will be held on Thursday, February 10th, 1927.

Junior Institution of Engineers.—The forty-sixth session of the above Institution will be inaugurated by a meeting on October 1st, when a paper, "Notes on Transformer Testing and Test Plant Requirements," will be read by Mr. L. Smith (Durham Bursar). The chair will be taken by Lieut.-Col. F. R. Durham, C.B.E., M.C. (vice-president), at 7.30 p.m. Meetings will be held every Friday evening during the session, and the arrangements for the remainder of the month of October are as follows:—October 8th, "A Survey of Modern Airless Injection Oil Engines," by Norbert J. Griffin; October 15th, "China from the Engineer's Point of View," by R. L. Sarjeant, B.Sc.; October 22nd, "Boiler Accidents," by R. H. Kenyon; October 29th, "Distortion in Wireless Reception," by A. V. Ballhatchet. The annual general meeting will be held on November 12th, and the induction of Engineer Vice-Admiral Sir Robert B. Dixon, K.C.B., as president of the Institution will take place on December 3rd.

Institution of Fuel Economy Engineers.—We have received a copy of the provisional programme for the session 1926-27 of the above Institution. The following lectures have been arranged for:—"Liquid Fuels," by Dr. A. E. Dunstan, September 24th; "Pulverised Fuel Firing and its Application to Modern Boiler Houses," by A. L'Herminier, November 5th; "The Loss of Heat from a Surface by Radiation and Convection," by Dr. T. Barratt, F.Inst.P., December 3rd; "Utilisation of Low-grade Fuels for Steam Generation," by W. F. Goodrich, M.B.E., January 7th.

Our Personal Column.

(Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.)

Shoreditch B.C. has fixed the salary of Mr. W. WEEKES, the borough electrical engineer, at £1,000 per annum, increasing to £1,250.

Oldham Town Council has increased the salary of Mr. R. WORCESTER, designer and superintendent of works at the new generating station, from £450 to £500 per annum.

Ald. ALBERT SMITH, chairman of the Keighley Corporation Electricity Committee, is to be the next Mayor of Keighley.

According to the *S.A. Mining and Engineering Journal*, Mr. H. W. CLOTHIER, managing director of Messrs. A. Reyrolle and Co., Ltd., of Hebburn-on-Tyne, arrived in Johannesburg early in August. He was making a tour of the principal towns of the Union.

Mr. W. H. PRICE notifies that he has resigned his position as managing director of Price's Electrical Supplies, Ltd., Birmingham, and has formed a new company under the name W. H. Price & Newey, Ltd., at 57, St. Paul's Square, Birmingham.

Obituary.—MR. J. RICHMOND.—The death occurred suddenly in the street at Folkestone on September 16th of Mr. Joseph Richmond, electrical engineer, of West Ealing. He was 84 years of age.

MR. L. KAMM.—*The Times* records the death, in his 66th year, of Mr. Leo Kamm, A.M.I.E.E., of Hornsey Lane, Highgate.

Will.—The late Mr. F. J. W. LUCK, chief engineer to the Westinghouse Electrical Manufacturing Co. in Brazil, left £20,324.

New Companies Registered.

Barlborough Electric Supply Co., Ltd. (216,253).—Private company. Registered September 17th. Capital, £3,000 in £1 shares. Objects: To carry on at Barlborough and elsewhere the business of an electric lighting and supply company in all its branches, &c. The directors are: H. H. Berresford, Duckmanton Lodge, Calow, near Chesterfield (commercial manager, Staveley Coal & Iron Co., Ltd.); D. J. Barnfather, School House, Barlborough, near Chesterfield; J. H. Clarkson, Balmoral Terrace, Barlborough; J. W. Gregory, Mill House Farm, Barlborough; H. J. Thompson, Ashleigh, Barlborough; E. Melbourne, Thornleigh, Barlborough. Qualification, £100 shares. Secretary, J. Robinson. Solicitors, Wake & Sons, 25, Bank Street, Sheffield. Registered office, Beechwood House, Barlborough, near Chesterfield.

Sky Signs, Ltd. (216,283).—Private company. Registered September 17th. Capital, £1,500 in £1 shares (1,000 15 per cent. cumulative part preference and 500 ordinary). Objects: To acquire in the U.K. or elsewhere any site or sites for the purposes of displaying electrical flashing, rotating, scintillating, ante chromatic, spelling or "talking" and other advertising signs, &c., to carry on the business of electrical and mechanical engineers, &c. The permanent directors are: W. T. Williams, 35, Claude Road, Cardiff, coal exporter (managing director); S. W. Richards, M.E.M.P.I., Brynawel, Taffs Well, mining engineer; A. L. Owen, address not stated; N. C. Welsh, 31, Mount Stuart Square, Cardiff. Qualification, £50. Secretary, N. C. Welch.

Cowell, Wyatt & Co., Ltd. (216,123).—Private company. Registered September 9th, 1926. Capital, £1,500 in £1 shares. Objects:—To acquire the business of a wireless and electrical engineer carried on by Arthur Lee, trading as Cowell, Wyatt & Co., at 47, Abingdon Street, Northampton. The directors are:—C. R. Becke, 32, Newland, Northampton, company director (chairman); A. Lee, 91, Streatham Hill, S.W.2, hosier; M. Wetherall, address not stated. Qualification, 200 shares. Remuneration as fixed by the company.

Smalls', Ltd. (216,187).—Private company. Registered September 13th. Capital, £500 in £1 shares. Objects:—To carry on the business of manufacturers, importers and exporters of, and dealers in minerals of all kinds and mica and insulating apparatus and materials, electricians, machinists, wood and metal workers, motor and cycle fittings and accessories, wireless, electric, magnetic, telegraphic, telephonic, and other appliances, &c. The directors are:—W. R. Small, "The Haven," Hasluck Green Road, Shirley; and R. Small, Grove House, Stanklyn, Stone, Kidderminster. Qualification, 1 share. Registered office: 178, Aston Road, Birmingham.

Lodgen, Ltd. (216,183).—Private company. Registered September 13th. Capital, £300 in 1,000 "A" shares and 2,000 "B" shares of 2s. each. The objects are:—To acquire from Sir Oliver J. Lodge, E. E. Robinson, and M. M. Melinsky the benefit of certain inventions; to acquire patents relating to the development or improvement of telegraphy or telephony or wireless telegraphy or telephony, or any electric or similar science or art, &c. The subscribers (each signing for one "A" share) are:—A. H. Skan, 4, Copthall Chambers, E.C.2, solicitor; E. Edwards, 29, Glaskin Road, Hackney, E.9, clerk; and H. E. Skan, "Littlecote," Huntercombe Lane, Maidenhead, solicitor. The directors are:—M. M. Melinsky, P. H. Brashier (appointed by holders of "A" shares), and A. H. Carlisle (appointed by holders of "B" shares). Whilst the maximum number of directors is three or more than three, the holders of the "A" shares may appoint two, and the holders of the "B" shares one, director. Remuneration as fixed by the company. Solicitors: Romer and Skan, 4, Copthall Chambers, E.C. The registered office is at 4, Copthall Chambers, E.C.2.

Phonodex, Ltd. (216,244).—Private company. Registered September 16th. Capital, £100 in £1 shares. Objects:—To carry on the business as manufacturers, distributors, selling agents for appliances for use with telephone installations or telephone equipments, to conduct advertising campaigns, &c. The directors are: E. P. Giles, "Newlands," Keble Road, Maidenhead, advertising manager (managing director); H. Q. Cregan, 63, Brondesbury Road, N.W.6, chartered accountant. Qualification, 1 share. Registered office, 10-12, Copthall Avenue, E.C.2.

Official Returns of Electrical Companies.

Rawlings Bros., Ltd. (67,908).—Capital, £100,000 in 70,000 ordinary and 30,000 preference shares of £1 each. Return dated September 1st, 1926. 50,744 ordinary and 20,685 preference shares taken up. £71,429 paid. Mortgages and charges, nil.

British Glowlamp and Valve Co., Ltd.—Particulars filed of £300 debentures authorised September 10th, 1926, charged on the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued.

Mawdsleys, Ltd.—Satisfaction in full on September 9th, 1926, of debentures dated May 27th, 1907, May 3rd, 1909, and September 12th, 1910, securing £6,300.

Radiocraft Supplies, Ltd.—Debenture charged on the company's property, present and future, including uncalled capital, dated September 7th, 1926, to secure all moneys due or to become due from the company to Barclay's Bank, Ltd.

Callington and District Electric Supply Co., Ltd.—Particulars filed of £1,000 debentures authorised August 7th, 1926, charged on the company's property, present and future, including uncalled capital, the amount of the present issue being £750.

City Notes.

Reports and Meetings of Electrical Companies, Dividend Results, &c.

Burndept Wireless Co., Ltd.

The *Financial Times* states that a meeting of the preferred ordinary shareholders has been called for September 28th to consider a resolution for the issue of £50,000 in £100 debentures at 7 per cent. interest redeemable on June 30th, 1929, at £106, or at the option of the company at any time prior to June 30th, 1928, at £103. The balance-sheet for 1925 shows the cash resources of the company to be much depleted. An advance of £50,000 made by the bankers has been utilised in reducing the amounts due to trade creditors, in making payments in respect of the new extensions to the factory at Blackheath (which is now completed and in full working order), and in making advances to the company's subsidiary, Radio Accessories.

"It was hoped that this advance by the bankers would be sufficient, not only to meet cash demands, but, in addition, to finance production on a proper scale for the season now commencing. Such, however, has not been the case, and unless a further sum be raised at this juncture the board will be unable to make proper provision for essential expenditure and so take advantage of the business which now lies before the company.

"The only secured creditor of the company, and the only creditor who would stand before the debenture holders, is the company's bankers, and the company will covenant with the debenture holders that they will not borrow from the bank any sum in excess of a total of £60,000, or create any prior charge.

"It is anticipated that the company, if satisfactory progress be made, will not require the money for any long period. The notice states that promises to take up these debentures, at par and free of underwriting commission, have already been received to a substantial extent, but if the issue is sanctioned the debentures will be offered in the first instance to the shareholders for subscription."

East Anglian Electricity Supply Co., Ltd.

The first annual meeting of this company was held at Ipswich on September 15th, the chairman (Mr. F. M. Rogers) presiding. The *East Anglian Daily Times* reports that in the course of his speech the chairman said that the surplus was £8,536. After providing for the preference dividend and transferring £6,000 to general reserve, an ordinary dividend of 5 per cent. was recommended. During the year the company had been granted Orders in respect of districts around Braintree and Sudbury. They contemplated applying for further Orders for districts in Norfolk, Suffolk, and Essex. They had offered to purchase the Felixstowe undertaking, which was being worked by agreement with the Council, but that had not met with the Council's approval. Special capital expenditure had been authorised for developments in Stowmarket and Framlingham, and further extensions were being made at Diss and in the Braintree area. Up to March 31st last the company had sold 1,009,559 kWh, and it had 3,250 consumers. Mr. Bradbrook referred to the resignation of the chairman, Lieut.-Col. H. W. Woodall, through poor health. He had transferred his interests in the company, thus removing the financial difficulties which the company had had for many years. The appointment to the board of Messrs. F. M. Rogers, A. Winterbottom, and B. G. Drummond was confirmed, and Messrs. Bradbrook and Goodall were re-elected directors.

Swiss Electrical Companies.

La Société des Usines Electriques de la Lonza, of Basle, is raising a new loan of 25 million Swiss francs (approximately one million sterling), at 5½ per cent., in order mainly to pay off 5 per cent. bonds to the extent of 13,185,000 fr., which fall due for repayment early next year.

The Electrical Values Co., of Glarus, records net profits of 562,000 fr. for 1925, as compared with 510,000 fr. in the preceding year.

The Bank for Electrical Undertakings, of Zurich, reports net profits of 5,634,000 fr. for 1925, as compared with 5,033,000 fr. in the previous year, the dividend on the "A" and "B" shares being at the rate of 9 per cent., as against 8 per cent. in 1924.

The Watt Electrical Undertakings Co., of Glarus, after an interruption of ten years, proposes to pay out of net profits of 103,000 fr. a dividend at the rate of 2½ per cent. on the share capital, which was reduced from 10,000,000 fr. to 3,500,000 fr., of which 1,460,000 fr. is unpaid. The loans remain unchanged at 7,000,000 fr.

The Motor-Columbus Company for Electrical Undertakings, of Baden, Switzerland, reports net profits and balance forward amounting to 6,530,000 fr. for 1925, as compared with 5,860,000 fr. in the previous year, and the dividend rises from 9 per cent. in 1924 to 10 per cent. for last year on a share capital of 60,000,000 fr., the loans reaching 85,500,000 fr. A tone of great optimism prevails throughout the directors' report. The steady increase in the consumption of energy, the report states, necessitates a constant extension of existing works and the erection of new ones, so that the possibilities of activity will not be lacking for a long time to come. The technical progress made by the steam power stations has caused these to come into serious competition with hydro-electric works, the value of which in Switzerland is frequently over-estimated. The preliminary labours in connection with the Ryburg-Schworstadt hydro-electric works, which has been in hand for 16 years, have now so far progressed that the formation will shortly take place of the company foreseen for the purpose. This particular works is the large Rhine power station to be established below Sackingen.

French Companies.

The *Compagnie Française pour l'Exploitation des Procédés Thomson-Houston*, Paris, which has a capital of 300 million fr., reports a profit of 12,148,932 fr. for the last financial year, as compared with 14,940,561 fr. in 1924, and 23,425,486 fr. in 1923. No dividend is being declared.

The *Compagnie Parisienne de Distribution d'Electricité* which has a capital of 100 million fr., reports a net profit of 37,409,025 fr. for the last financial year, as compared with 34,451,647 fr. in 1924.

The *Société d'Electricité de Paris* records net profits of 8,983,000 fr. for 1925-26, as compared with 8,191,000 fr. in the previous year; the dividend is increased from 60 fr. per share in 1924-25 to 65 fr. for the past year.

The *Société l'Electro-Entreprise* states that, as the railway companies have temporarily suspended their electrification programmes, the industrial branch is at present mainly engaged upon work for groups of communes for the electrification of country districts, although some power transmission and canal equipment works are in hand. The accounts for the year ended last February show a loss of 97,000 fr.

The *Compagnie de Signaux et d'Entreprises Electriques* reports having established in 1925-26 a factory for the construction of electric lamps, particularly for special signal lamps, in view of the expected extension of light signals on the French railways. The various departments had a satisfactory year, although the activity of the company in Italy did not have any influence on the profits. After writing off 3,481,000 fr. for depreciation, the accounts show net profits of 2,747,000 fr., as compared with 2,673,000 fr. in 1924-25. A dividend at the rate of 5 per cent. has been declared.

Australian Company.—*Construction Co. of Australia, Ltd.*—This company (formerly Automatic Telephones, Ltd.) reports a net profit of £9,334 for the year ended June 30th last, as compared with £13,949 in 1924-25. A dividend at the rate of 20 per cent. has been paid. The capital was reduced from £100,000 to £62,500 during the year by the repayment of part of their capital to preference shareholders.

Stock Exchange Notices.—Dealings in the following have been specially allowed by the Committee under Rule 159:—

Chili Telephone Company.—30,000 new ordinary shares of £5 each, fully paid, Nos. 150,001 to 180,000.

The undermentioned securities have been ordered to be officially quoted:—

Electrical Distribution of Yorkshire.—500,000 ordinary shares of £1 each, fully paid, Nos. 1 to 500,000.

Hopkinsons, Ltd.—The directors have declared an interim dividend on the ordinary shares at the rate of 10 per cent. per annum, calculated from the due dates of the instalments to July 31st last. The dividend equals 7.857d. per share.

Direct Spanish Telegraph Co., Ltd.—Interim dividends at the rate of 10 per cent. per annum on the preference shares and of 4 per cent., free of tax, on the ordinary shares have been declared.

Ward & Goldstone, Ltd.—An interim dividend of 7 per cent. per annum on the cumulative participating preference shares for the half-year ending the 30th instant, is to be paid on that date.

Clarke, Chapman & Co., Ltd.—The directors state that they are unable to declare an interim ordinary dividend on account of the general strike and coal stoppage.

British Aluminium Co., Ltd.—The directors have declared an interim dividend of 4 per cent. (actual), less tax, on the ordinary shares, as in 1925.

Folkestone Electricity Supply Co., Ltd.—Interim dividend of 8 per cent. per annum, free of income tax, on the ordinary shares for the half-year.

Stocks and Shares.

MONDAY EVENING.

WE hear, unofficially of course, that a strong hint has been given to auditors and others that expedition is desirable in presenting electricity supply companies' accounts in the matter of reserves, &c. If affairs are allowed to drift for much longer, a hopeless position of chaos must ensue. The Act came into force from January 1st this year, and every week adds to the trouble that piles up in the way of arriving at a just arrangement of the companies' capitals. There is nobody, director, auditor, secretary, or common shareholder, who can tell what is going to be the upshot of the existing position. The Stock Exchange axiom is that a man should hope for the best and prepare for the worst—the cynic may remark that the same applies to matrimony—but in the electricity supply business it is impossible to say what is going to happen.

Price-changes in the market for these shares are necessarily slight: they cannot be otherwise while the period of uncertainty lasts. Kensington ordinary shares are 5s. up at 13¾. Chelseas at 2 have recovered the dividend deduction; so have Clyde Valley shares. South London, ex 1s., are unchanged at 2¾: the dividend on these, and the yield on the shares, are the same as those of the Kensington Company. The Folkestone Electricity Company declared a dividend of 8 per cent. free of tax; the price is 36s. 3d. ex dividend.

The Electric Light & Power Contracts Finance Corporation has again circulated prospectuses offering preference shares and "Participating premium notes." We have referred on previous occasions to the group of which this company is one, Sir Charles B. H. Soame being the chairman of several of the undertakings. The investor should steer clear of them all, if he has any regard for the safety of his capital. The prospectus now in front of us, that of the Electric Light & Power Contracts Corporation, is a collection of vague, but unsatisfying, statements that carry little conviction to the ordinary informed person.

Marconis are flat at 13s. 9d. middle, and have changed hands down to 13s. It is assumed that a writing-off of 5s. to 10s. per share will probably be found necessary. If 10s. per share were so disposed of, the position of the company's participating preference would become somewhat piquant. Canadian Marconis are dull at 3s. 7¼d. Radios remain around 10 and the preferred are 9¾.

The redoubtable Mr. Alfred Lowenstein has left London again, and his movements are being followed with lively attention by those people who are also following the Brazilian Traction group. Tractions themselves are unchanged at 120, and the preferred are 107 ex dividend. Sidros, Barcelona Tractions, and Mexico Trams have been steady.

Activity developed in Bournemouth & Poole ordinary upon a suggestion of probable amalgamation or absorption. The obvious "other" party would be the County of London Company, but nothing has transpired, up to the time of writing, from responsible quarters. Bournemouths rose to 58s. 6d. before reacting to 57s., which leaves 1/16 rise on the week. There has been a good deal of animation in Telephone Manufacturing shares, the price of which touched 8s. This tempted selling by underwriters of the latest-offered shares at 7s. 6d., and the price eased off to the latter quotation. Telegraph Constructions are 10s. higher at 29¼, the demand being stirred by the impression that the time cannot be long delayed when an increase in dividend or a bonus distribution will be announced. The yield at the present price is no more than 4¼ per cent. free of tax.

Cable stocks and telephone shares are firm. Eastern ordinary, Eastern Extensions and Westerns are better. The two first-named have declared their usual three-monthly dividends of 2½ per cent., tax free. Another free of tax dividend is the interim 4 per cent. from the Direct Spanish Telegraph Company. The ordinary shares stand at 8 and the 10 per cent. preference at 7¼ middle; both are £5 shares fully-paid.

Newcomers in the early future are expected to include the Baghdad Electric Company, with a capital of £250,000. The concession stands in the name of a well-known London group.

Underground Electric Railways' £10 shares are ¼ harder at 3¾. The other Tube issues are quiet, and steam stocks underwent a mild improvement at the end of last week—for no particular reason, for the news in connection with the coal-stoppage is no more promising than it has been for many weeks past. Engineering and allied shares are disposed to droop, although Babcocks keep good at 53s., attracting attention from London and provincial investors. In rubber shares, the volume of business is as small as the tone of the market is steady.

British Columbia Electric Railway stocks have given way, the deferred losing 4 points. Mexican Light Common rose 2½ and the company's first mortgage bonds at 70 are 1 higher. Argentine issues hold their prices, and no movements have occurred in the British traction descriptions.

Share List of Electrical Companies.

HOME ELECTRICITY COMPANIES.

	Nom.	Dividend. 1924.	1925.	Price Sep. 20 1926.	Rise or fall.	Yield p.c.
	£					
Bournemouth and Poole	1	14	14	57/-	+1/6	5 0 5
Brompton Ordinary	1	10	10	1 5/8	—	5 12 2
Charing Cross Ordinary	1	15	15	44/6	—	6 14 10
do. do. 4½ Pref.	1	4½	4½	17/6	—	5 2 10
Chelsea	1	12	12	2xd	+9d.	6 0 0
City of London	1	15	15	49/6	—	6 1 3
do. do. 6% Pref.	1	6	6	23/-	+6d.	5 4 4
Clyde Valley	1	8	8	27/-xd	+6d.	5 18 6
County of London	1	15	15	58/3xd	—	5 3 1
do. do. 6% Pref.	1	6	6	23/-	—	5 4 4
Edmundson's Ordinary	1	7	8	26/-	—	6 3 1
do. 7% Pref.	1	6	7	22/6	—	6 4 5
Elec. Supply Corporation	1	10	10	31/3	—	6 8 0
Kensington Ordinary	5	15	15	13 3/4	+1/4	5 9 1
Lancs. Light and Power	1	7½	7½	24/-	—	6 5 0
London Electric	1	10	10	32/-	—	6 5 0
do. do. 6% Pref.	5	6	6	5 1/8	—	5 11 7
Metropolitan	1	11	11	37/-	—	5 18 11
do. 4½% Pref.	1	4½	4½	17/6	—	5 2 10
Midland Counties	1	5½	6	21/-	—	5 14 3
Newcastle-on-Tyne Ordinary	1	7	7	21/3	—	6 11 9
do. 5% Pref.	1	5	5	17/6xd	—	5 14 3
do. 7% Pref.	1	7	7	24/-xd	+3/8	5 16 8
Notting Hill 6% Pref.	10	6	6	10	—	6 0 0
North Met. Elec. 6% Pref.	1	6	6	22/6	—	5 6 8
St. James' and Pall Mall	5	17½	17½	16 1/8	—	5 8 6
South London	1	15	15	2 3/8xd	+1/-	5 9 1
South Metropolitan Pref.	1	7	7	1 1/8	—	5 12 0
Urban Ordinary	1	4	7	1 7/8	—	5 17 11
do. 6 % Pref.	1	6	6	20/6	—	5 17 1
Westminster Ordinary	1	15	15	43/9	—	6 17 2
Whitehall Elec. Invst. 7½% Pref.	1	7½	7½	20/6	—	7 6 4
Yorkshire Elec.	1	8	8	27/-	—	5 18 6

HOME RAILS.

Central London Ord. Assented	Stock	4	4	69	—	5 15 11
Metropolitan	,,	5	5	62	—	8 1 4
do. District	,,	9½	9½	51½	—	6 15 11
Underground Electric Ordinary	10	Nil	Nil	3 1/4	+1/8	Nil
do. do. "A"	1/-	Nil	Nil	11/6	—	Nil
do. do. Income	Bonds	6	6	100	—	*6 0 0

TELEGRAPHS AND TELEPHONES.

Anglo-Am. Tel. Pref.	Stock	6	6	104	—	5 15 5
do. Def.	,,	1½	1½	24 1/2	—	6 1 3
Automatic Telephone	1	3	10	2 1/16	—	3 16 0
Chili Telephone	5	5	6	7 1/2	—	4 1 4
Cuba Sub. Ord.	10	5	5	7	—	7 0 0
Eastern Extension	10	10	10	19 1/2xd	+1/2	*5 4 8
Eastern Tel. Ord.	Stock	10	10	190½	+1	*5 5 0
Globe Tel. and T. Ord.	10	10	10	19 1/2	—	*5 3 11
do. do. Pref.	10	6	6	11xd	—	5 9 1
Great Northern Tel.	10	22	20	27½	—	7 5 6
Indo-European	25	8½	10	47½	—	*5 5 0
Marconi	1	10	Nil	13/9	−1/16	... ...
Marconi-Marine	1	10	7½	20/-	—	7 10 0
Oriental Telephone Ord.	1	12	12	46/3	—	*5 3 10
United R. Plate Tel.	5	8	8	8½	—	*4 17 0
Western Telegraph	10	10	10	18 3/8xd	+1/8	*5 7 8

HOME AND FOREIGN TRAMS, &c.

Anglo-Arg. Trams First Pref.	5	5½	5½	3	—	9 3 4
do. do. 2nd Pref.	5	6	6	2 1/2	—	11 8 2
do. do. 5% Deb.	Stock	5	5	76	—	6 11 7
British Electric Traction Ord.	,,	7	8	140	—	5 14 4
do. do. 6% Pref.	,,	6	6	110	—	5 9 1
Brazil Traction	100	4	5	120	—	4 3 4
Brit. Columbia Elec. Rly. Pcc.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	96/-	126/9	112½	−2½	*5 9 1
do. do. Deferred	,,	129/5	8	139	−4	*5 15 1
do. do. Deb.	,,	4½	4½	77½xd	—	5 7 7
London & Sub. Trac. 5% Pref.	1	2½	Nil	5/-	—	Nil
London United Tram. Deb.	Stock	4	4	47	—	8 10 2
Mexico Trams, 5% Bonds	—	5	5	68½	+1	7 7 1
Mexican Light Common	100	Nil	Nil	34	+2½	Nil
do. Pref.	100	Nil	Nil	85½	—	Nil
do. 1st Bonds	—	5	5	70	+1	7 2 10
Yorkshire (West Riding)	1	5	—	11/6	—	... ...

MANUFACTURING COMPANIES.

Babcock & Wilcox	1	12	13	2 1/2	—	4 16 9
British Aluminium Ord.	1	5	10	47/6	−9d.	4 4 8
British Elec. Transformer Pref.	1	Nil	7	18/3	—	7 13 5
British Insulated Ord.	1	15	15	8 1/4xd	+2/-	4 5 9
Brush Ord.	1	10	10	26/3	—	7 12 4
Callenders	1	15	15	3 1/2	—	4 11 9
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	Nil	Nil	13/3	—	... ...
Edison-Swan	4/-	10	10	12/9	—	3 2 7
do. 5% Deb.	Stock	5	5	86	—	5 16 3
Electric Construction	1	10	10	31/9	—	6 6 0
Enfield Cable Pref.	1	7½	7½	1 1/2	—	6 6 4
English Electric	1	5	Nil	16/3	—	... ...
do. do. Pref.	1	6	6	18/-	—	6 13 4
Gen. Elec. Pref.	1	6½	6½	23/-	—	5 13 1
do. Ord.	1	5	7½	31/-	—	4 16 9
Henley	1	16	20	4 1/2	—	4 16 10
do. 4½% Pref.	5	4½	4½	4 1/2	—	5 6 0
India-Rubber	1	5	5	23/-	—	*4 6 11
Johnson & Phillips	1	10	17½	66/3	—	5 5 8
Met.-Vickers Ord.	1	8	8	25/9	—	6 4 9
do. Pref.	2	8	8	2 3/4	—	6 14 9
Siemens Ord.	1	7½	7½	32/-	—	4 13 9
Telegraph Construction	12	20	10	20 1/2	+1/2	*4 2 0

*Dividends paid free of Income Tax.

Market Quotations for Chemicals and Metals.

IT should be remembered, in making use of the figures appearing in the following list, that in some cases the prices are only general and they may vary according to quantities and other circumstances.

CHEMICALS, &c.		Price Sept. 21st.	Fortnight's inc. or dec.
a Acid, Oxalic	per lb.	5¾d.	...
a Ammoniac, Sal	per ton.	£60	...
a Ammonia, Muriate (large crystal)	,,	£52	...
a Bisulphide of Carbon	,,	...	...
a Borax	,,	£25	...
a Copper Sulphate	,,	£25 10s.	...
a Potash, Chlorate	per lb.	4d. to 4¼d.	...
a ,, Perchlorate	,,	5½d.	...
a Shellac	per cwt.	£15 15s.	...
a Sulphur, Commercial	,,	£9 10s.	...
a ,, Roll	,,	£9 10s.	...
a Soda, Chlorate	per lb.	3½d. to 3¾d.	...
a ,, Crystals	per ton.	£5 to £5 5s.	...
a Sodium Bichromate, casks	per lb.	4d.	...
METALS, &c.			
b Aluminium, Ingots	per ton.	£120 to £125	...
b ,, Wire	per lb.	1/9 to 2/6*	...
b ,, Sheet	,,	1/6 to 2/-	...
p Babbitt's Metal and Anti-friction Metal—			
Grade I	per ton net.	£173	£16 inc.
Grade II	,, ,,	£191	£11 inc.
Grade III	,, ,,	£199	£4 inc.
c Brass (rolled metal 2" to 12" basis)	per lb.	9¼d.	...
c ,, Tubes (solid drawn)	,,	1/0 to 1/0½d.	...
c ,, Wire, basis	,,	10½d.	...
c Copper Tubes (solid drawn)	,,	1/1	...
c ,, Bars (best selected)	per ton.	£90	...
c ,, Sheet	,,	£90	...
c ,, Rod	,,	£93	...
d ,, (Electrolytic) Bars	,,	£67	5/- dec.
d ,, ,, Sheets	,,	£14 10s.	...
d ,, ,, Wire Rods	,,	£77	5/- dec.
d ,, ,, H.C. Wire	per lb.	9½d.	½d. dec.
f Ebonite Rod	,,	2/3 to 2/6	...
f ,, Sheet	,,	2/3 to 2/6	...
g German Silver Wire	,,	2/2	...
h Gutta-percha, fine	,,	8/-	...
h India-rubber, Para fine	,,	1/8	...
j Iron Pig (Cleveland No. 3.)	per ton.	72/6	...
j ,, Wire, galv. No. 8, P.O. qual.	,,	£21	...
g Lead, English pig	,,	£33 10s.	5/- dec.
g Mercury	per bot.	£15 10s. to £16	2/6 to 10/- inc.
		£15 10s.	
e Mica (in original cases) small	per lb.	3d. to 3/-	...
e ,, ,, medium	,,	4/- to 8/-	...
e ,, ,, large	,,	10/ to 20/- & up.	...
p Phosphor Bronze, plain castings	,,	1/3½	...
p ,, ,, drawn bars & rods	,,	1/3	...
p ,, ,, rolled strip & sheet	,,	1/2½	...
p ,, ,, wire	,,	1/4	½d. inc.
o Platinum	per oz.	£33 10s.	...
d Silicium Bronze Wire	per lb.	11½d.	...
r Steel, Magnet, in bars	,,	7½d.	...
n Tin, Block (English)	per ton.	£310 to £311	£11 5s. to £11 15s. inc.
n ,, Wire, Nos. 1 to 16	per lb.	4/3	...

*For 1 cwt. lots. Special quotations against definite specifications.

Quotations supplied by

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d Frederick Smith & Co.
e F. Wiggins & Sons.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakespeare.
h Edward Till & Co.
j Bolling & Lowe.
l Richard Johnson & Nephew, Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p C. Clifford & Son, Ltd.
r W. F. Dennis & Co.

Electrical Fires in Bavaria.—The fire insurance company which has a monopoly of building insurance in Bavaria has, states *Elektrotechnik und Maschinenbau*, recently issued a report dealing with the subject of defective electrical installations and fire danger. A distinction is made in the report between cases in which fires were unquestionably due to the electrical installation and those in which this was merely suspected of being the cause. Of the fires in buildings which occurred in 1923-24, it is reported that 1.42 per cent. were undoubtedly due to faults in the electrical installation, while 4.43 per cent. were suspected cases. In both categories the majority of the fires occurred in farm buildings, 88 per cent. of the insurance money paid over being in relation to fires of this class. An inquiry into the prevalence of fires in electrically-equipped farms showed that 23 per cent. were due to non-protected motors and a similar percentage arose from conductors passing through roofs under which hay and straw were stored. Fires arising from faulty electrical installations are said to be increasing at the rate of 0.9 per cent. per year, and the amount of indemnity paid in respect thereof has increased in the past few years from 1.01 per cent. to 9.8 per cent. The report concludes with the remark that the matter is one that should receive the attention of electrical firms, which, on the one hand, should take greater care in making installations in farm buildings and, on the other, issue simple instructions to farmers regarding the precautions that must be taken to prevent fires.—*Electrical World.*

The Rating of Electricity Undertakings.—Representatives of North Wales Assessment Committees last week held a meeting at Chester to consider the assessment of electrical undertakings. It was decided that an executive committee of ten should be appointed for the purpose of considering the position of electricity undertakings and other relevant matters.

Exports and Imports of Electrical Goods and Machinery in August, 1926.

THE influence of the holiday spirit was very apparent during August, causing a decline in all three sections of our foreign electrical trade. The seriousness of the decrease of £216,000 in the month's export total is discounted by a comparison with the figure for the previous August, which gives an increase of £138,000. This, incidentally, lowers the total decrease in exports for the expired portion of the year.

The decrease as compared with July was fairly general; there were only three increases, and these were of small moment. The largest actual fall occurred in the exports of unenumerated electrical goods and apparatus (£57,000), but the greatest proportional decrease was exhibited by batteries and accumulators. Unenumerated electrical machinery and unclassified motors and generators were also among the classes which declined considerably. Submarine telegraph and telephone cable made another sudden descent.

Although, as compared with the corresponding month of last year, the exports were greater as a whole, the decreases predominated in number. Submarine cables again accounted for a large fall, but railway and tramway motors also experienced a considerable decline. The biggest rise occurred in insulated wires and cables (£112,000); telegraph and telephone apparatus was also well up (£76,000).

There were several large movements in the import section, but the net result was only a decline of £27,500 from the July figure. More significant was the fall of £64,834 as compared with August, 1925. There was no repetition of the unusual event which occurred in July —the importation of submarine cable. The item which appears to have "suffered" most severely in the import division is unenumerated electrical machinery.

The favourable trade balance (ignoring re-exports) for the first eight months of the year is £7,992,505, as compared with £8,350,855 for January-August, 1925.

There was little of interest in the re-export section, except that the decrease, as compared with July, was at about the same level as the increase over the August, 1925, figure.

	Exports.			Imports.			Re-Exports.		
	Electrical exports for Aug., 1926.	Inc. or dec. as compared with July, 1926.	Inc. or dec. as compared with Aug., 1925.	Electrical imports for Aug., 1926.	Inc. or dec. as compared with July, 1926.	Inc. or dec. as compared with Aug., 1925.	Electrical re-exports for Aug., 1926.	Inc. or dec. as compared with July, 1926.	Inc. or dec. as compared with Aug., 1925.
Electrical goods and apparatus (unenumerated)	£147,659	— £57,376	+ £7,538	£86,194	+ £1,213	— £3,339	£4,873	— £1,442	— £412
Insulated wires and cables ...	268 173	+ 7,516	+ 112,352	44,664	— 14,198	+ 4,986	1,475	— 1,664	+ 1,361
Glow lamps	39,933	— 10,146	— 10,551	30,555	+ 11,974	— 11,297	1,083	+ 764	+ 359
Arc lamps and parts	727	— 133	— 9	350	— 315	— 288	218	+ 215	+ 156
Batteries and accumulators ...	74,282	— 52,795	— 9,702	57,672	+ 4,192	+ 720	210	— 85	— 307
Meters and instruments ...	42,367	+ 6,377	+ 7,608	17,447	— 543	— 10,909	178	— 568	— 527
Carbons...	949	— 149	— 3,744	15,574	+ 10,077	+ 6,789	390	+ 375	+ 367
Electrical Machinery—									
Electrical machinery (unenumerated)	259.159	— 45,564	+ 5,583	76,842	— 27,780	— 29,290	9,478	+ 478	+ 5,275
Railway and tramway motors	31,632	+ 6,636	— 23,027	—	—	—	—	—	—
Other motors and generators...	171,561	— 26,982	— 8,550	—	—	—	—	—	—
Switchboards (not telegraph or telephone)	2,542	— 5,355	— 1,391	439	+ 424	+ 436	—	—	—
Telegraph and Telephone Cable and Material—									
Telegraph and telephone wires and cable (not submarine)	63,601	— 7,454	+ 22,714	6,093	— 4,810	— 8,758	4	— 2,019	— 343
Submarine telegraph and telephone cable...	5,104	— 29,817	— 34,626	—	— 5,500	—	—	—	—
Telegraph and telephone instruments and apparatus ...	296.575	— 858	+ 76,059	29,740	— 2,291	— 13,834	2,386	— 1,394	— 694
Totals	£1,404,324	— £216,120	+ £138,154	£365,570	— £27,557	— £64,834	£20,295	— £5,340	+ £5,226

	Exports.	Imports.	Re-exports.
Decreases for eight months of 1926 ...	£762,249	£403,899	£36,451

The Electric Welding of Structural Steel.

Test Results on Specially-Designed Specimens.

IN order to demonstrate that steel structures can be built up by means of electric arc welding, and joints produced that will not fail even when loaded up to the rupturing loads of the structural members, a series of tests was recently carried out under the direction of the Westinghouse Electric and Manufacturing Co., U.S.A., at the Carnegie Institute of Technology by Mr. J. M. Daniels, instructor in charge of the Materials Testing Laboratory.

In one case, a double cantilever structure I beams weighing 21.8 lb. per foot, 3 ft. long, were secured to a vertical 8-in. H column, 32 lb. per foot. Seat angles were welded to the column faces, and on these the beams were landed and their ends welded to the column faces; the edges of the bottom flanges were also secured to the seat angles. Plates were also welded to the column, and the beams horizontally at the top joints and web plates were welded between the column flanges in line with the beam flanges. Six pounds of welding wire was used, and the time taken to make the specimen was 4 hours. The yield point of this specimen under test was 50,000 lb., and the ultimate load was 75,100 lb. The ultimate bending moment at the column face was 125,000 in.-lb.

In another test the structure was a single cantilever specimen comprising a 12-in. I beam, weighing 28½ lb. per foot, a 12-in. vertical H column, 65½ lb. per ft., and a 12-in. H base member of the same weight per foot. The I beam was welded to the column in a similar manner to that in the first test, and the column was welded to the base member, vertically standing on its end, a reinforcing plate being used in this case. This complete specimen weighed 649 lb., and a total of 12 lb. of welding wire was used. The work was done in 6 hr. 40 min. The yield point was 35,000 lb., and the ultimate load 59,200 lb. The ultimate bending moment at the face of the column was 200,000 in.-lb. This specimen failed by web crippling of the I beam, there being no indication of any distress in any of the welded joints.

To demonstrate principally a beam subject to shear load, a 6-in. I beam, 12½ lb. per foot, 2 ft. long, was secured between two 8-in. H columns, 32 lb. per foot, 1 ft. 9 in. long, standing on a base member of 8-in. H section, 3 ft. 4½ in. long. Web plates were used in the base member, and two stiffening plates

were used for the column-base joints. The specimen weighed 266 lb., and the welding wire required was 7 lb. 2 oz. The time expended was 3 hr. 40 min. The yield point of this structure was 50,000 lb., and the ultimate load 83,000 lb. The load was applied at the centre of the specimen on a block 5 in. wide, located on the top flange of the I beam. Failure in this case took place by web crippling of the I beam. A particularly interesting test was where two cantilever I beams were secured to the web of a main girder of a structure, at right angles to the girder. The I beams were of 9-in. section, 21.8 lb. to the foot, and 3 ft. long. The main girder was 15-in. I section, 42.9 lb. per foot, and 1 ft. long. The two seat angles were used. Owing to the inaccessible space between the top face of the 9-in. beam and the upper flange of the main girder, it was next to impossible for an operator to make a good weld at this point where the tension stresses are concentrated. Therefore, to assist in welding, wedge blocks were inserted so as to permit the operator to build up arc deposited metal over the end and edges of these wedge blocks, thereby producing a tie between the flanges of the 15-in. I and the flanges of the 9-in. cantilever I beams. This specimen complete weighed 187 lb., there being required 4 lb. 2 oz. of welding wire. The total welding time was 2 hr. 10 min. The span for loading this structure was 5 ft. 7½ in., and the yield point was 55,000 lb.; the ultimate load 64,000 lb.

In another instance a pair of 15/16-in. diameter hot-rolled-steel rods were welded end-wise to the two faces of a 12-in. I beam, 31.8 lb. per foot, 6 in. long, representing the construction where similar rods are attached to the bottom faces of the I beams and girders for hangers to support balconies and mezzanines. Each rod was welded to the under face of the I beam in an overhead position to exactly duplicate field-construction work. The specimen failed by breaking the rod approximately 12 in. from one face of the I-beam section. The yield point was 23,200 lb., and the ultimate load 35,000 lb. Only 8 oz. of welding wire was required, and the time expended was 45 min. A very severe test for welded joints was made in one case where a 15-ft. girder was built up by welding two flanges to a web plate. The web was of 14 in. by 5/16 in. steel, and the flange plates 10 in. by ¾. The top flange was welded to the web plate continuously along each side, but the bottom flange was only welded to the web plate solid for a distance of 6 in. from each end, and then by intermittent joints 2 in. long on 4 in. centres for the rest of the distance on each side of the web plate. Web stiffeners were welded solid to the flanges at each end, and also intermittently to the web. The specimen was tested by centre loading on a block 5 in. wide, the span being 14 ft. Failure was brought about by the buckling of the top flange. The elastic limit of the specimen was 65,000 lb., and the ultimate load 78,000 lb. This specimen had a total finished weight of 656 lb., which is materially less than that of a corresponding riveted girder. A total of 30 lb. of welding wire was used, and the total welding time was 12 hr. 33 min. This shows the advantage of designing structures for welding, by placing the metal in the locations where the greatest strength can be developed with the amount of material used. It also demonstrates the fact that the parts to be joined need not be lapped as is required where rivets are to be used for securing the members.

The test specimens were designed by Mr. Gilbert D. Fish, consulting structural steel engineer to the Westinghouse Company.

Many papers on electric welding read before British engineering institutions were reported in the ELECTRICAL REVIEW in 1919, and the application of arc welding to structural steel work was described on May 14th, 1920, p. 615.

A New American Steel.—The development of a new steel product—steel with a high resistance to wear but a soft core—is announced by the Jones and Laughlin Steel Corporation. The company's officials say that the product, which is named "Jalcase," will reduce production costs and speed up the output of parts for machines where steel of great wear resistance is required for moving parts. "Jelcase," it is said, with its hard surface and soft core, possesses the triple combination of fast machining, case hardening and forging properties.—*Reuter's Trade Service* (Pittsburgh).

An Electric Sight-Seeing Vehicle.—At a recent exhibition in Philadelphia, celebrating the 150th anniversary of the declaration of American independence, there was a new type of electric sight-seeing machine. The body, on the lines of a giant jaunting car, was built by the J. G. Brill Co., of Philadelphia, and fitted to an electric chassis made by the Commercial Truck Company of the same city. The vehicle is 33 ft. long and 7½ ft. wide, the accommodation being sufficient for 40 people. The two longitudinal seats are separated by an aisle 21 in. wide, the whole body being covered by a canopy. The maximum speed is eight m.p.h., and the weight, in running order, but without passengers, is about 5½ tons. A fleet of 25 of these vehicles was in use at the exhibition.

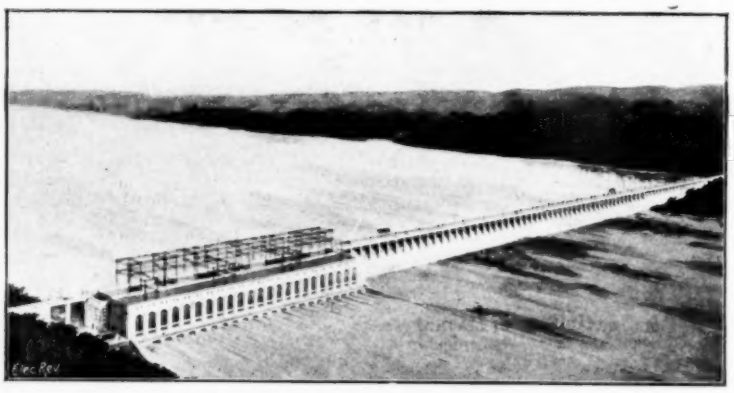
The Conowingo Hydro-Electric Project.

An American 440,000-kVA Development Scheme.

SECOND only to that of the Niagara Falls Power Company, and surpassing Muscle Shoals in the United States, will be the hydro-electric plant which is being built for the Philadelphia Electric Power Company on the Susquehanna River, within four miles of tidewater. A dam 4,800 feet long, 300 feet longer than the Muscle Shoals dam, is being built across the river to form a reservoir of 8,100 acres; the impounded water will drive turbo-generators, and the energy will be sent to Philadelphia, 75 miles away.

Ultimately the Conowingo hydro-electric station will contain 11 generators, each rated at 50,000 h.p., or 36,000 kW; the initial installation will include seven such sets, giving the station 350,000 h.p.; the Niagara Falls Power Company's development produces 452,500 h.p., and Muscle Shoals 260,000 h.p. Four of the waterwheel-driven generators for this scheme are being constructed by the General Electric Company of America; they are rated at 40,000 kilovolt-amperes, 90 per cent. power factor and 13,800 volts, with a speed of 81.8 r.p.m. It is expected that 1,360,000,000 kilowatt-hours will be produced by the Conowingo plant in an average year; three-quarters of a million tons of coal a year will be saved thereby.

The Conowingo hydraulic works will develop an average net head of 89 feet; the river bed is of granite, assuring a firm foundation for the dam. Across the top of it there will be a highway bridge, 105 feet above the foundation, as a part of the main highway between Baltimore and Philadelphia and replacing a bridge which will be submerged in the reservoir. The spillway section will extend eastward from the centre of the dam; the power house westward. On top of the spillway, the crest of which will be 86 feet above sea level, will be 50 movable steel gates, 22½ feet high and 40 feet wide. They will maintain the water level behind the dam at 108½ feet above sea level; with all the gates open, the discharge rate of the spillway will be 880,000 cu. ft. of water per second.



Conowingo Hydro-electric Plant, Maryland, U.S.A.

The power house itself will be 175 feet wide and 620 feet long, with an ultimate length of 900 feet. From the bottom of the draught tubes to the top of the high-voltage switching station on the roof it will be 230 feet high, and it is interesting to note that the bottom of the draught tubes will be 25 feet below sea level.

The electricity produced at 13,800 volts will be stepped up to 220,000 volts by transformers and at this pressure sent over two transmission lines to Philadelphia. Each line will have sufficient capacity to carry the full load in case of trouble with the other one. When the final four generators are added to the power station, a third transmission line will be constructed.

The Susquehanna watershed of 27,000 square miles includes a large part of the central section of Pennsylvania, a considerable section of the southern New York State, and a small portion of north-eastern Maryland. The average river flow is 40,000 cubic feet per second.

The Conowingo hydro-electric development will be co-ordinated with the steam-turbine generating plant of the Company, so that the water power will be used to supply the base load of the system when the flow of the river is ample, and the steam stations will carry the peak load. When the river flow is small, the steam station will be used to carry the base load, and the water power will be called upon only for peak loads. When the river flow is sufficient for full operation, Conowingo will supply 231,000 kilowatts for base load; when the river is low, the reservoir will be called upon, and statistics covering a period of 35 years show that in the driest period of the year Conowingo will be able to supply 190,000 kilowatts for peak loads.

The construction of the 8,100-acre reservoir means that the little town of Conowingo, with only 200 inhabitants, must be abandoned; fifteen miles of a line of the Pennsylvania railway must be relocated; and five miles of main highway from Baltimore to Philadelphia must be built, with a bridge over the dam to replace the one which will be submerged.

The Municipal Tramways Association.

Annual Conference at Liverpool.

(*Concluded from page* 457.)

Public Policy in Relation to Tramways and Motor-Omnibuses.

By Councillor Major J. FITZGERALD JONES, M.C., Deputy Chairman, Salford City Tramways Committee.—(*Abstract.*)

Road passenger transit is now an integral part of our communal life, and is destined to play such an important role in the commercial and social well-being of our people that very close examination of its present condition and future potentialities is vitally necessary. The parlous financial position of some municipal undertakings, and the expanding operations of private companies, either running complementary services in extension of, or competitive ones along existing routes, call for judicial inquiry and decision, based primarily upon considerations of public service and economy. Aggressive development on the part of privately-owned 'bus-operating companies in or about areas which are operated by municipalities, with their statutory limitations, is occasioning deep concern on financial and social grounds, and is giving rise to problems with which only Parliament can properly deal. Unless some Government policy is speedily adumbrated and given effect to by statute, which will co-relate and regulate all passenger road service, the country will reap a bitter harvest of financial loss, economic waste, and indifferent service.

Approximately £75,000,000 of public money has been sunk in municipal passenger carrying undertakings, and it is so undesirable that they should become a charge upon the rates that no effort must be spared to produce economy in working and a steady growth of revenue. On the other hand, tremendous sums have been invested in "independent" 'bus companies which are perfectly legitimate undertakings, and it is impossible to contemplate any immediate legislation which is calculated to diminish the facilities with which they were favoured on formation. It is along other avenues that we must proceed, therefore, if we are to establish conditions which will give that which the public is entitled to expect, *viz.*:—

(1) Efficient and economic service;
(2) Elimination of useless competition,
(3) Equitable return upon capital invested either by municipalities or private operators.

No measure of agreement would ever be attained voluntarily between rival undertakers to secure these ends, and legislative energy must be directed to devising a scheme in which these separate interests shall live amicably side by side and become active participants in a great co-ordinated national service.

The present system of national control of the production and distribution of electrical energy by municipal and private undertakers (and passenger transport is no less important than electricity) plainly indicates the direction in which we must go. I suggest the following broad outlines of policy to that end:—

1. Passenger Transport Commissioners to be appointed by the Government, to establish Parliamentary responsibility for the proper conduct of, and to co-relate, all passenger transport services, whether municipally or privately owned.
2. Local Area Passenger Transport Boards, including technical, legal, and commercial members, to be formed, to define areas and co-ordinate and determine services, authorise inter-running arrangements, sanction scales of fares, &c.

The scheme would definitely place the onus of inter-area regulation upon Parliament, through a responsible Minister, and the inauguration of Area Control Boards would ensure that the wider interests of public policy would be the determining factors, instead of self-satisfied inefficiencies in management, and pettifogging "parish-pump" rivalries which seek to create and maintain artificial boundaries to public travel.

The slow-moving passenger electric car makes limited appeal to distance riders, either of the utility or pleasure class, and therefore the *element of time or duration of travel* is becoming the transcending factor.

The phenomenal growth of mechanically-propelled freight and passenger transport upon streets which were designed to meet the demands of slow-moving horse-drawn vehicles only, makes insistent call for new methods of street operation.

The street car cannot be surpassed for mass transportation during the hours of big loads, but more thought must be given to the question of the right size of unit to be used during the light and heavy traffic periods of the working day.

The consensus of opinion in America, Australia, Great Britain, and Europe, after many years of trial and experiment, appears to favour the small as against the large unit, and for some years a tremendous boom has been seen in the United States of America in the development of smaller modern, light-weight cars, with automatic equipment for facilitating the rapid loading and unloading of passengers with the minimum of accident risk. Big units are used on a number of systems in Great Britain, but for the greater part of the day such units are inefficient and their use most extravagant.

The problem might be dealt with effectively and efficiently by the use of two or three street car trains (multiple control), or by means of street car and trailer. In this country the latter method has been tried more than once with results which were not always satisfactory, but neither was the motor 'bus in its earlier or even its more recent stages, and I am not satisfied that the last word has been said on multiple control or the use of trailers. Both methods have the advantage of flexibility: the capacity of the train can be increased to meet the load requirements, and rush-hour traffic is so closely akin to railway traffic conditions that even to the lay mind, train, as distinct from single-vehicle, operation clearly indicates the direction in which to search for a solution.

In order that the right type of servant shall be attracted to the service and that managements may make impartial staff selection free from the demoralising influence of outside pressure, which is usually of a political character, employés should only be appointed, on probation, after passing physical and educational tests laid down and conducted by an independent authority. The management should then make final selection from successful candidates.

Discussion on Major Jones's Paper.

Alderman R. T. FLETCHER (Wigan) said the best part of the paper was that relating to Area Boards, because if towns could have a voice in transport control for a distance of 10 or 20 miles from the centre of their areas, much good might be done. It was possible for rural authorities to combine for the purpose at least of advising as to the granting of licences to private individuals to run 'buses, and he mentioned one case in which this had been done.

Alderman F. SMITH (Liverpool) suggested that the one cardinal error throughout the paper was to rely upon Parliament to deal with the very complicated question of the traffic in our various towns and cities. These problems could only be dealt with adequately by men who were familiar with the areas to be dealt with, and the conditions obtaining in them.

Alderman A. G. ELLAWAY (Birmingham) agreed with the author's statement that efforts should not be directed so much to insensate opposition to private enterprise, but to the equalisation of the burdens and opportunities and to participation and co-operation in a co-ordinated service, which would yield a maximum of benefit to the rider with a minimum of disturbance. He did not believe that any good would come from further Parliamentary interference with passenger transport. He objected to the author's suggestions as to the use of big units in this country. This had been considered very carefully in Birmingham, and, after a report was prepared on the subject, the Council had turned it down. In America and on the Continent, for the most part, the streets were wider and less tortuous than ours.

Alderman R. WARING (St. Helens) said it seemed that the scheme put forward by the author favoured private enterprise. There seemed to be a suggestion to combine, under one authority, all the small concerns in the country, with their various standards of equipment, and he wondered what kind of conglomeration that would be. A more practical method would be a co-ordinated effort, having full regard to the public interests, and not tenderly considering private interests. The Government and the municipalities should take steps for the proper co-ordination of the municipal transport services; it was more a question for the nation at large and the various councils than for private enterprise.

Councillor THICKETT (Walsall) congratulated the author upon his courage in expressing his views in the way he had, but disagreed with the statement that we should have to look to Parliament as the only authority which could deal with this class of problem. In some cases we should have to change the personnel of the management. Again, the author was in favour of giving private enterprise a better run for its money, but his own view was that if municipal enterprise had a fair field and no favour it could run private enterprise off the streets in no time.

Alderman PERCIVAL BOWER (Lord Mayor of Birmingham), said that the suggestion that Tramway Committees brought undue pressure to bear upon their managers was untrue. He did not believe that the public life of this country, as represented by local government administration, was permeated by what was suggested in the paper.

Councillor V. L. MCENTEE (Walthamstow) contended that the average worker to-day, through improved education, was advancing in outlook, in culture and in knowledge, and must have more freedom for expressing his opinions equally with those in charge of the management of municipal undertakings.

Councillor J. H. WHITTAKER (Todmorden) said that in any agreement made with tramway employés in the future, definite provision must be made against such an unwarrantable interference with the rights of the public to ride upon tramcars which they provided as had occurred during the general strike.

Mr. W. MURRAY (Walthamstow) said that tramway undertakings had so developed the traffic in various parts of the country, and had established such a goodwill, that they should be definitely protected from motor-'bus competition.

Mr. C. A. HOPKINS (Wigan) said that trailer cars had been tried in this country on many occasions and abandoned as useless for our conditions.

Alderman J. K. CHEETHAM (Oldham) disagreed emphatically with the suggestion of Transport Commissioners or Area Boards having any jurisdiction in large towns where, he contended, the tramway committees were fully capable of determining the nature of the extensions to be made. If the suggestion for Transport Commissioners and Area Boards were carried out it seemed to him that it would practically result in the elimination of tramway managers as a body.

Major JONES, replying to the discussion, said that the bulk of the criticisms had been based on a misapprehension of the paper because, in fact, his aim was to secure all that had been suggested as necessary. It seemed to him that he was the only real democrat present because the traffic problem could only be dealt with on national lines, yet so many of the speakers had objected to any form of control by way of co-ordination. As to the position of employés, there was a growing desire on the part of labour agitators to run the tramways instead of allowing that task to be done by the duly elected representatives and it was for that reason he had made the comments on this matter which he had. There had been objection to any form of outside control over local tramway developments, but there had been no suggestion in the paper that there should be. With regard to influence being brought to bear upon tramway managers and committees to find men jobs, in spite of what had been said, he again asserted it was a fact that this existed in too many parts of the country. On the general labour question, what he desired to see was a period of stabilisation within the industry so that development could go along on rational and normal lines. He urged tramway authorities to look to their cars and systems generally in order to make them up to date and competitive with the modern motor-'buses as an important means for holding their own with 'bus competition, because both methods of transport had their fields. Without some methods of co-ordination and regulation, however, neither would develop to the best advantage of the public and that was why he had so strongly advocated the establishment of Transport Commissioners and Area Boards.

Road Passenger Transport.

By A. BAKER, General Manager of the Birmingham Corporation Tramways. (*Abstract.*)

TO-DAY there are 2,634 miles of tramways electrically operated in this country, over which 4,450,000,000 passengers are carried annually. The car-miles run over these tramways reach the enormous figure of 361 millions.

So far as the larger towns and cities are concerned tramways, in moving large masses of people cheaply and expeditiously, are still unrivalled. As an illustration I may mention Manchester, where on some routes between the hours of 7 and 9 a.m., cars having a capacity of 80 passengers each, running at intervals of about 30 seconds, are required to accommodate the number of passengers desiring to travel. Birmingham has the same frequency of service, but being narrow-gauge the cars carry only 60 to 70 passengers. No other known system of transport can possibly deal with a situation of this kind without causing such congestion of the streets that the conditions would become hopeless.

It is recognised that the greater the number of vehicles required to meet traffic requirements the greater the congestion, with consequent slowing-up of the traffic and loss of valuable time to the travelling public.

The slogan of "Scrap the Trams" is simply propaganda invented and fostered by people interested in other methods of traction. It does not emanate from the millions of tramway passengers who use the cars daily and who are assured of a cheap, frequent, and reliable service, a service that could be more efficient and cheaper still if it were not for the unfair burdens imposed upon tramway operators by the Tramways Act. If omnibus proprietors had to shoulder the same burdens as tramways, the addition to their operating costs in respect of maintenance of permanent way and the rates thereon would be at least 2d. per 'bus mile.

The London General Omnibus Company, according to the latest published annual accounts, ran 137,000,000 'bus miles. If this company were under the same obligations as tramways with regard to road maintenance and rates, its operating costs would be increased by upwards of one million pounds per annum. It may be argued that 'bus companies pay for road maintenance in their Inland Revenue 'bus licences. Allowing for this, however, the company is in a better position than tramways by no less a sum than £500,000 per annum. Further, motor-omnibuses require expensively built modern roads, which have to be maintained by the local authorities at a high cost.

Motor-omnibuses and trolley vehicles have their fields of service, but at present neither type of vehicle can possibly deal with traffic of the density I have referred to. I say nothing about the capital that would be lost if tramways were scrapped beyond stating that at the end of the year 1924 the capital invested in tramways amounted to ninety-two million pounds sterling.

It is generally recognised that tramway undertakers who are statutory bodies having vast amounts of money invested in their undertakings should have some sort of protection against unrestricted and unregulated competition. Under certain conditions the same protection should be afforded to the omnibus undertakers who have created traffic, against the unbridled competition of "fair-weather operators." I am at the same time strongly of the opinion that private operators should have *imposed upon them the same obligations with regard to fares, services, and cheap fares for working classes as are imposed upon municipal statutory undertakings.*

If the same obligations rested upon the shoulders of private omnibus proprietors as those enjoyed by municipalities there would be no question of competition. Omnibuses could not live alongside tramcars for a single day.

There is also the question of the disabilities under which municipalities suffer in connection with the obtaining of powers to operate motor-omnibuses.

The trolley vehicle is probably, from a passenger-carrying point of view, the most comfortable public vehicle known. For ease in running, rate of acceleration, cheapness of operation, it has no superior—yet, in my opinion, it has a very limited field of service. It is a first-class substitute for tramways in places where the traffic density is not too heavy, and where the standards, wires, and cables are already installed.

The future development of passenger road transport lies in the direction of six-wheel motor-omnibuses, such as are now used so very extensively in America. The overall length of these vehicles may be up to 30 feet, and they have a carrying capacity of 65 to 70 passengers, with a maximum weight of approximately 12 tons.

Discussion on Mr. Baker's Paper.

Mr. J. K. BRUCE (General Manager, L.C.C. Tramways) said that although there were now three methods of passenger street transport available, *viz.*, the tramcar, the trolley-'bus, and the motor'-bus, it would be difficult to substitute anything for the tramway completely under the circumstances of many towns without considerably adding to the congestion of the traffic on the streets. They had had experience of that during the general strike. Mention had been made in the paper of dense tramway traffic in Manchester and Birmingham where, at times, there was a 30-second service, but in London on the Embankment, where there was no 'bus traffic, there were tramcars every 18 seconds at times, and over 30,000 people were moved per hour. Yet in that place the tramcars and track took up a relatively small portion of the roadway. One of the troubles of the tramways was that they had to carry workmen at cheap fares during part of the day and then share the traffic during the rest of the day with the 'buses, and that was unfair. When listening to the talk of "scrap the trams" they must remember the large amount of capital sunk in them, and the fact that interest and redemption charges would have to be paid even if the tramcars were taken off the streets at once. For instance, if the tramways in the county of London were scrapped, the redemption and interest charges at the moment would amount to £1,000,000 per annum, and although this sum would decrease as years went on, there would, nevertheless, be a large expenditure required for removing the tracks from the streets, and that would be unproductive expenditure.

Mr. E. S. RAYNER (General Manager, Hull Corporation Tramways) said it must be appreciated that a much greater change had come over the passenger transport question through the advent of the motor-'bus than had been the case when they changed from the horse car to the electric car. In that case it was a question of the capacity of the vehicle; now they had to consider the capacity of the roads to carry the vehicles. From that point of view, preference must be given to the tramcar because it not only carried more passengers per vehicle, and thus took up less road space per passenger, but it did not damage the roads to anything like the extent motor-'buses did, and it must not be overlooked that the taxpayer had to pay for that damage. It was for this reason that he favoured some control of the kind outlined in Major Jones's paper. Hundreds of thousands of pounds were wasted annually in the maintenance of roads through damage caused by superfluous vehicles, having regard to the needs of the traffic, because there were many places that were being served by many more 'buses, for instance, than were really required. Here was work for a traffic control authority, and he suggested that the policy of such an authority should be to give priority to that form of passenger transport which occupied the least road space per passenger carried. That was the tramway in the busy areas of towns.

Councillor ALAN DAVIES (Wolverhampton) pointed out that the Wolverhampton Corporation had gone in largely for trolley 'buses, but apparently Mr. Baker did not favour their use unless the poles and wires were already in existence, and it was also running a large number of motor-'buses which were found to run economically and satisfactorily. The Corporation also had on the stocks a six-wheeled motor-'bus capable of seating 60 passengers, and it was clear to his mind that these newer types of 'buses were going to be serious competitors of tramways. Wolverhampton had extended its trolley 'bus routes, and after four years was satisfied, but he wondered whether it would be wise to continue to do so, having regard to motor-'bus developments. It was found that the cost of erection of overhead wires and poles for trolley 'buses came to only about 2 per cent. more than adapting an old tramway route for the purpose.

Mr. H. MATTINSON (General Manager, Manchester) suggested that the competition of motor-'buses would prove to be a good thing, for the tramway industry had shown a tendency, in the years just before the war, of growing a little lax under the influence of the possession of a monopoly. Much of the congestion for which the tramcar was blamed was really caused by other vehicles standing outside premises.

Alderman J. WALKDEN (Wigan) spoke in favour of trolley vehicles in view of the fact that in Wigan profits had been made upon trolley 'buses where previously no profits had been made upon tramways running over the same routes. More-

over, one route which had cost £10,000 to construct would have cost £34,000 had tramways been adopted. A profit of £3,200 had been made in the first year of running.

Bailie BURT (Glasgow) said there was no need to be despondent about tramways if only tramway managers and committees would make the cars as attractive as 'buses. He also thought the competition of the motor-'buses would prove to be a good thing for the tramway industry.

Alderman FENTON (Sheffield) said that the question of motor-'buses *versus* tramways had been very much to the fore in Sheffield, and mentioned one case in which the inhabitants asked for 'buses instead of tramways. The point to be impressed upon the public, however, was that 'buses could not be provided at tramcar fares because 'buses cost so much more to operate. He urged that the Tramways Act should be modified to relieve tramway authorities of the cost of maintaining the tracks and remarked, as showing how much the ordinary traffic wore out the tramway track, that some rails taken up in Sheffield after a number of years, during which tramcars had not been running upon them, showed greater wear than did the track in other parts upon which there had been a continuous service of cars.

Alderman HIGHAM (Blackburn) said that if anybody was going to endeavour to remove tramways from the centre of busy towns and so put the passengers to the inconvenience of having to walk some distance to their final destination, he would find himself in a hornets' nest.

Motor-'bus Traffic in and Around Glasgow.

By BAILIE ROBERT LAING, Convener of the Glasgow Tramways Committee. (*Abstract.*)

Our total system now extends to 270 miles of single track, and the distance from the Eastern to the Western terminus is practically 25 miles; the scheme laid down by the Corporation many years ago is now almost complete, which means that every community within a reasonable distance of the City has been connected up with the centre of Glasgow by tramway line. To lay down and equip this extensive tramway system has cost the Corporation of Glasgow over £6,500,000. It will readily be seen, therefore, why the members of the Corporation during the past eighteen months have been extremely anxious regarding the new development in road traction, and the competition which the tramways have now to meet.

According to the latest available returns there are now 600 motor-'buses doing business in the city. Nearly all these vehicles are owned and garaged in the towns and districts surrounding the city. This means that the city derives very little revenue by way of rates from the owners of these vehicles. They are wearing the surface of our roads and streets; they are causing congestion; they are taking up a large part of the time and attention of the Police Force; they are maiming and killing our citizens and, apparently, there is no redress.

There is no doubt that during the past two years the tramway revenue has been adversely affected by the competition of the motor-'bus. Throughout the city itself the effect is not so much felt, but even there we are losing traffic to a considerable extent.

So far as the city routes are concerned, I do not think that a good service of tramcars has very much to fear from motor-'bus competition; but the situation is entirely different on the long outlying routes where the traffic may be thin and where speed is an important factor.

We have now, therefore, to ask ourselves the question: Have we to abandon these outside lines, or can we successfully meet the omnibus competition by bringing our tramway system thoroughly up-to-date? I am not yet satisfied that a tramcar cannot be made which will hold its own with a motor-'bus.

In the first place we must increase the speed of the tramcar, and we must also see that the speed of the motor-'bus is kept within reasonable limits. I do not think there will be any difficulty in equipping a tramcar in such a way that we will get a comfortable ride at 20 miles per hour, or even at a greater speed. I would not suggest that the speed of the motor-'bus should be restricted to the legal maximum of 12 miles per hour. All that I would ask is that the authorities should see that the motor-'bus is driven at a reasonably safe speed.

The motor-'bus has it own sphere and its own work to do and so has the tramcar. I am not going to advocate the scrapping of the tramways until I am satisfied by a fair test that the motor-'bus is the better vehicle.

At the present time we are experimenting with various types of trucks in order to increase our speed, and in order to make the riding more comfortable at the higher speed. Recently we have abolished a very large number of stopping-places throughout the system, and this has enabled the department to add a mile an hour to the schedule speed. At present we are building a new single-deck car with four-motor equipment. This car will be fitted with the ordinary hand-brake, the electric brake, and the air brake, and we are also putting new trucks and more powerful motors underneath two or three of our present double-deck cars.

The Corporation of Glasgow has been carrying through an experiment in fares of which the main purpose is to strike an effective blow at the 'bus competition.

Under the new scale it has been made possible on one route to travel nearly 21¼ miles for 2d., and other routes measure 19.56, 15.31, 12.85, and 11.57 miles from terminus to terminus. There has been a substantial increase in the number of 2d. passengers, and the revenue from this fare exceeds the amount received during the corresponding period of last year from fares of 2d. and over. It was expected there would be a falling-off in the number of short-distance passengers. The returns since July 1st show such a drop in the 1d. and 1½d. fares; that although the department is getting ¼d. more from the short-distance traveller, the total revenue from the 1d. and 1½d. fares is down practically the same amount as the increase from the 2d. fares. The new fares have not been in operation long enough to permit of a final opinion, but the effect in countering the 'bus operation has been definitely proved. There is no doubt that the tramcar can operate, for mass transportation, at a cheaper rate than any 'bus, and the public—especially the Scottish public—always appreciates a bargain. With cheap fares, accelerated service, and up-to-date equipment, the tramcar is still pre-eminent in the transport field.

Discussion on Mr. Laing's Paper.

Alderman T. WOFFENDEN (Huddersfield) said the outstanding feature of the paper was the apparent lack of control, in Glasgow, over the operations of private motor-'bus proprietors, and it was high time they had some system of co-ordination and control generally throughout the country. It was astonishing to find that smaller towns like Huddersfield were able to exercise a certain amount of control in this respect, whilst a large city like Glasgow could not.

Councillor JAMES SUTCLIFFE (Mayor of Burnley) expressed the view that if tramways could not be run to beat the motor-'bus then tramways ought to go. At the same time, until the 'buses were placed under the same obligations as the tramways there would not be fair competition.

Mr. R. S. PILCHER (Manager, Edinburgh Corporation Tramways) suggested the desirability of saying a little less about the advantages of the tramway and a little more about its disadvantages. The question of dealing with the rolling stock was the most important, and the matter had been dealt with in a joint report of the Association and the Tramways and Light Railways Association. Lighting, appearance, and comfort in riding were essential features in the success of tramways, and it was quite unnecessary nowadays to have noisy jazzing tramcars. Perhaps speed was the key to the situation. It was no use arguing that the tramcar was better than the 'bus, because the tramcar was best for some classes of traffic and the 'bus was better for other classes of traffic. In Edinburgh there were 340 tramcars and 100 'buses, and the interesting feature was the tendency for the 'bus-route mileage to increase at a greater rate than the tram-route mileage. Tramway authorities would find it necessary to experiment with 'bus routes in their cities, even if at a small loss to begin with; otherwise they would find private enterprise coming in.

Mr. W. MURRAY (General Manager, Walthamstow) said that compared with his district the Glasgow Corporation did not yet know what motor-'bus competition was, because on the basis of the position in Walthamstow, Glasgow should have some 1,300 or 1,400 'buses running on its tramway routes instead of 611, and no doubt it would have them in time. His own view was that to rely, as Glasgow appeared to do, upon the 2d. fare for the long distances to make up the losses on the short distance was an unsound policy.

Alderman F. SMITH (Liverpool) did not like the moan that ran through the paper that Glasgow was being hard hit by motor-'bus competition. One method of dealing with tramway traffic was to offer an inducement to the regular rider by way of a discount, the tickets being sold in packets. That had been done in Liverpool with success.

Mr. H. MOZLEY (General Manager, Burnley) asked why Glasgow had waited 30 years before taking steps to protect its tramway undertaking from motor-'bus competition, because it was plainly visible 30 years ago that it was coming. His other point was that local authorities should confine their transport undertakings to their own districts.

Mr. J. BARNARD (General Manager, Bolton) referred to the difficulties experienced by his Tramway Committee in getting motor-'bus powers from Parliament and to the handicap which a local authority suffered from in having to go to Parliament under the present procedure. In his own case he had to schedule certain routes in October, and it was not until the following August that he could run the 'buses, because he had to wait for the Royal Assent to the Bill. In the meantime, private owners, knowing the routes that had been scheduled in the Corporation Bill, had begun to run 'buses on them, whilst the Corporation had a whole fleet of 'buses in the garage which could not be used.

Bailie LAING briefly replied to the discussion.

ERRATA.—On page 456 of our last issue, in the list of awards made at the Conference, for "Gunning" read "Dunning"; also, Mr. Stanley Dawson is not with Rotherham Corporation, but is employed in the Sheffield Corporation Tramways and Motors Department.

Conditions in Sweden.—The *Swedish Economic Review* for the third quarter of 1926 (published by the Swedish Board of Trade) says that employment in the shipbuilding industry during the last few months has improved and the electro-mechanical trade has continued its activities under satisfactory conditions. On the other hand, the depression in the iron industry has continued. The returns for the first half of the current year show that electrical machines to the value of 12,556,000 kr. were exported, as compared with 8,381,000 kr. during January-June, 1925. The exports of telephone and telegraph apparatus were valued at 2,825,000 kr., as compared with 3,065,000 kr.

The Iron and Steel Institute.

Summer Meeting in Sweden.

It is 28 years since the Iron and Steel Institute last held a meeting in Sweden, and when a large and representative group of the members assembled in Stockholm recently they were in a position to estimate the considerable development which the Swedish iron and iron-mining industries had undergone during the past quarter of a century, from the technical as well as from the quantitative point of view. Perhaps the most notable feature is the extraordinary development of electricity supply, since the introduction of which undreamt-of opportunities have presented themselves for planning works rationally, and for modernising practically the entire equipment. In fact, electric power has resulted almost in the remodelling of the whole iron industry of Sweden. A general idea of the extent of this development may be got from a summary of a paper presented to the Iron and Steel Institute by Prof. Arvid Johansson and Mr. Axel Wahlberg, of Stockholm.

Development of Electric Power Supply.

For lighting purposes direct current had been in use since the early 'eighties, but it was not until 1890 that alternating current made its appearance. The Swedish ironworks were ready immediately to utilise this development, and motors were installed in old as well as in recently-erected rolling mills, the power being transmitted from a near or distant waterfall.

Hydro-electric power was also used early for metallurgical purposes. F. A. Kjellin constructed the first electric induction furnace for melting steel at Gysinge in 1899, and eight years later the trials were begun in smelting pig-iron in an electric furnace at Domnarfvet. In 1925, T. Holmgren carried out an extensive investigation of the power question of the Swedish iron industry, from which we give the following data concerning electric pig-iron.

In 1923 there was produced in Sweden 52,148 tons of ordinary electric pig-iron, for an energy consumption of 132.2 million kWh, and 1,331,464 hectolitres of charcoal, or 2,540 kWh and 25.5 hectolitres for 1 ton of pig-iron. On a yearly production of, say, 500,000 tons of pig-iron, exclusively electric, there would be a saving of 18 million hectolitres of charcoal, that is, 18 million crowns, reckoning the price at 1 crown per hectolitre. If electric power could be obtained at a price of 0.8 öre per kilowatt-hour, the cost of the power would amount to 10 million crowns, and the real saving to 8 million crowns. Allowing for interest and depreciation the net saving would probably amount to 4.5 to 5 million crowns. This calculation shows that it would be an economy to substitute electric furnaces for blast furnaces provided that the electric energy could be obtained at a reasonable price.

The amount of water-power available in Sweden is 32,500 million kWh per annum. The electrical energy produced in 1923 amounted only to 2,980 million kWh, or 9.1 per cent. of what could be obtained. From this it will be seen that there are possibilities for a very extended use of electric power.

The Swedish Government has equipped its own waterfalls at Trollhättan, Alvkarleby, Porjus, Motala, and Lilla Edet, for the generation of electrical power, and from there the power is distributed to a number of works, including ironworks. Other waterfalls, belonging to the ironworks, have been equipped by the firms chiefly for their own use. In this connection may be mentioned the advantages obtained by co-operation. In 1917 there was formed a power company for the supply of power to a number of consumers and producers. This has met with success and the transmission and distribution lines of 12 ironworks, eight mines, and five independent power stations are now connected with the main line of the power company, the total generating capacity of the system being about 125,000 kilowatts. Variation of load, peak loads and overloads, are taken care of by the main system, and there is less need for reserve or spare plants than when working independently.

The development of Swedish pig-iron production is characterised by the introduction of the electric furnace where a certain portion of the charcoal has been replaced by electrical energy transformed into heat. The full-size furnace erected at Trollhättan in 1910 has fulfilled all expectations. Thus a high quality of charcoal pig-iron can be produced for a consumption of about 2,500 kWh per ton of iron made. It was built for a power consumption of 2,000 kilowatts and was provided with carbon electrodes, 660 millimetres square. Later furnaces have been built with six electrodes 600 mm. in diameter, and at one place Söderberg electrodes are used with good results. On account of the excellent quality of the pig-iron produced, the steel works at Uddeholm and Domnarfvet, which are well supplied with electric power, installed electric furnaces with capacities up to 4,500 kW.

	Trollhattan experimental furnace	Furnace of more modern design.
Interior height	10.8 metres	10 6 metres
Diameter of hearth ...	4 0 ,,	5.3 ,,
Diameter of shaft ...	2.3 ,,	3 2 ,,
Volume of smelting chamber.	12 5 m^3	35.0 m^3
Total volume	38.0	92.0
Loading, kW	about 2,000	about 4,000
Production per 24 hours...	18 to 20 tons	,, 37 tons

It is likely that the production of electric pig iron will develop, especially in the North of Sweden, where very cheap power is to be had and where there is a good supply of charcoal and iron ores suitable for this process. In Central Sweden lack of charcoal may promote the installation of electric furnaces instead of the old blast furnaces; there are now fourteen electric furnaces in Sweden, particulars of which are given in the table in the preceding column.

The production of ferro-alloys in electric furnaces is relatively extensive, several works producing ferro-silicon containing from 25 to over 90 per cent. silicon and ordinary silico-manganese.

In rolling-mill practice the most prominent feature is the use of the electric motor for mill-driving. The earlier installations used three-phase induction motors, the later ones being equipped with a slip resistance placed in the rotor circuit, by means of which a speed variation could be obtained, permitting a certain amount of energy to be stored in the flywheel during the pause between passes when rolling.

For barmills and wire-rodmills a much greater variation in speed was needed and obtained by means of the multipolar motor and the cascade induction motor. These solutions of the important problem give a simple and comparatively cheap installation, without transforming the three-phase current to direct current or, as at Hofors, regulating the speed of the generator. If only two speeds are desired one motor with multiple-pole connection, or tandem with cascade, is used. For a number of speeds both the systems are used in combination, where as a rule the number of poles of the main motor is changed, and the secondary motor is provided with single winding. In this way it is possible to obtain four speed ranges—two with the main motor alone, and two by connecting the secondary motor.

The tandem system with cascade connection was first used at Fagersta, where in 1900 a barmill and a wire-rodmill were equipped with electric drive, using energy from hydraulic power stations in the vicinity. Two years later five mills at Landviken were electrified, a load of 1,600 kW at 20,000 volts being transmitted from Näs, a distance of 55 kilometres. After transformation to 500 volts the power was used for driving three tube-mills, one barmill, and a universal mill. The tube-mills had ordinary three-phase induction motors with slip resistance; the other mills were equipped with the multiple-pole system and cascade connection, resulting in three different speed ranges.

The ordinary induction motor with slip resistance was used for three-high and other rolling mills, where no speed ranges were necessary, but where variable speed was required, cascade motors with multiple-pole connection on the main motor was used. For iron works with cheap power this system is advantageous, because of the low installation costs, but with a high price for power its use may be prevented by the high power loss. The Krämer system is now coming into more general use. In this system, the energy lost through slip resistance is put to useful work and a more varying speed is possible than with an alternating-current motor alone. The first installation, in 1916, for a wire-rod mill at Längshyttan, obtaining power from the hydro-electric station at Alvkarleby, consisted of a 100-h.p. alternating-current main motor, with a direct-current secondary motor on the same shaft. The energy of the slip resistance was transformed to direct current in a rotary converter and then returned to the direct-current motor. The alternating-current motor works alone at the highest speed, and lower speeds are obtained by varying the resistance in the shunt field of the direct-current motor. By these means the speed of the mill when rolling can be varied in the proportion 1 : 1.7, with an efficiency of about 90 per cent. and a load factor of nearly 1. In later years direct current has been adopted at new mills because it permits a wide range of speed variation while rolling, and gives a 90 to 95 per cent. efficiency at all speeds.

A motor-generator is used for transforming the alternating to direct current, and mercury rectifiers are being considered. The Leonard-Ilgner system is used for the reversing cogging mill at two steel works, and ingots 250 by 300 millimetres are rolled in two stands at the same time by rolls 650 to 700 millimetres in diameter, driven by an 800-h.p. motor.

At only one works in Sweden is an electric annealing furnace installed. The steel is placed on a car, covered with a brick-lined hood, and electrically heated by nichrome spirals embedded in the linings of the car and the hood. This furnace gives a uniform temperature, and is easy to handle because of the automatic regulation of the heat.

Electrical Ore Finding.

Two methods of ore finding are arousing much interest, and are noted in a paper by W. Petersson on the development of the Swedish mining industry during the last 25 years. One method—the potential method—is based on an investigation of the potential in an electrical field by tracing equipotential curves or measuring differences in potential between different points. The other method—the electromagnetic—is based upon investigations of the direction and intensity of an electromagnetic field. While the use of magnetic measurements is possible only for magnetite or magnetic pyrites, the electrical methods are suitable for practically all ore deposits, and by these means large deposits of copper, pyrites, zinc and lead ores have been detected near Skellefteå, in the north of Sweden.

The Institution of Public Lighting Engineers.

Annual Conference at Newcastle-on-Tyne.

THE annual conference of the Institution of Public Lighting Engineers, which was held in Newcastle-on-Tyne on September 14th, 15th, and 16th, was completely successful. The attendance was good, the arrangements were excellent, and the tone throughout the proceedings was exceedingly happy. To the members of the Institution the Lord Mayor of the city (Councillor A. Oates), on the Tuesday evening (the 14th) extended a hearty welcome to Tyneside. His Lordship claimed that Newcastle was one of the best lighted cities in the country in normal times. He then officially opened the exhibition of lighting appliances which was held in the concert hall. At the conclusion of the proceedings in the Town Hall, the members were taken round the city in Corporation 'buses to survey the system of lighting in use, and subsequently, at the invitation of the Lord Mayor, visited the Oxford Galleries.

So early as 9.30 on the following morning the Lord Mayor attended the opening session of the conference in the Connaught hall and welcomed members and delegates. He spoke appreciatively of the functions of the Institution, from the formation of which he saw that great advantages to public lighting might accrue. Later in the proceedings the new President, Mr. R. Davison, chief of the Newcastle lighting department, was introduced and the meeting proceeded to business. The visitors were entertained at luncheon in the Grand Assembly Rooms, at the invitation of the Lord Mayor and the chairman of the Lighting Committee (Alderman Alexander Wilkie), on behalf of the Council, after which followed a visit to Carville power station at Wallsend, at the invitation of Newcastle Electric Supply Co. It was a much-appreciated inspiration which prompted members of the Conference, before they commenced the business of the day on Thursday, to place a wreath on the City War Memorial.

The LORD MAYOR opened the business proceedings; he said that prior to the formation of the Institution public lighting had not received that degree of consideration at the hands of the civic authorities that was due to it and to the general public. At the exhibition which he opened the previous night, he was struck with the great progress that had been made scientifically in the various lamps. It was an acknowledged fact that where there was more light there was less crime. State research had brought public lighting more to the front: rapid strides had been made. He hoped they would have a beneficial conference and that something new might result from the discussions.

Proposing a vote of thanks to the Lord Mayor, the President said there still remained a lot of work to do in connection with the Institution, but they had made a little progress during the two years of its existence. He did not think they could lose sight of the fact that it was a waste of money to have a big police rate and a meagre lighting rate; they could not get good lighting without paying for it.

Mr. DAVISON seconded the motion, and said that the Mayor had been his right hand man in getting things through the Committee.

Mr. SHAKLEY (the retiring president) introduced his successor, Mr. R. Davison, and said they needed the utmost interest taken in the Institution and that could be done only by having new and live men to carry on their efforts. There was a lot of apathy throughout the country in regard to public lighting, and it was not the old cities and boroughs that could lead the way. Mr. Davison briefly thanked the members for the honour they had conferred on him, and he in turn proposed a vote of thanks to the retiring president; he then delivered his presidential address.

Presidential Address.

By R. DAVISON.

(*Abstract.*)

ALTHOUGH the Institution of Public Lighting Engineers is only in its infancy, there is already abundant evidence to the effect that it is arousing the interest of the local authorities. To the representatives of local authorities we extend a very hearty welcome, and trust that our meetings will stimulate still further their interest in the subject of public lighting. Through these representatives we get directly into touch with the person who pays the bill and enjoys the advantages of public lighting—literally, "the man in the street." This much talked of, much sought after, and very elusive person becomes after nightfall the supreme object of our solicitude, although, ironically enough, the better we light his path the less conscious is he of our existence.

A splendid opportunity of arousing interest in public lighting matters might be secured if members of the Institution and members of local lighting committees were prepared to give a series of short talks on public lighting in various parts of the districts which they control. This would not only reveal to the public some of the more interesting features of an undertaking, but afford them the opportunity of stating their views regarding the lighting of any particular district and bring them in closer touch with the lighting authorities. In this district lectures of local interest have of late years been an encouraging feature in the city's intellectual life, having been given under the auspices of the Free Libraries and also the Municipal Officers' Association. Another and more ambitious series was given a few years ago, when the Newcastle-upon-Tyne Literary and Philosophical Society carried through with great success a full University Extension Course entirely by local lecturers. If we can only stimulate interest on the part of the general public we shall have travelled a long way towards our goal, and co-operation in this endeavour with the representatives of the other municipal activities would, I think, tend to raise the level of intelligent citizenship and secure for the municipal officers the great boon of an instructed criticism and discriminating appreciation.

Our generation has witnessed a great change, the effects of which have not yet been fully realised or provided for. I refer to the greatly extended range and increased speed of vehicular traffic. The Ministry of Transport receives large sums of money from road users, and I am of the opinion that these people should have some consideration from the Ministry as to the lighting of our highways. It has been stated on many occasions that a public lamp is equal to a policeman, and I think you will readily agree that a public lamp is less costly. Let us consider the cost of lighting this city with its 260 miles of front and back streets. We find that the amount allowed for street lighting purposes for the financial year 1926-27 is equal to a lighting rate of 4.9d. in the £ on the basis of the recent new assessment, and if we take this figure a little further, it works out at .73d. per head of the population per week. It would probably be difficult to find an individual who was not prepared to pay double the amount per week so that he could have adequate and efficient street lighting. It is impossible to calculate the blessings of good lighting in £ s. d., but there is no doubt that a considerable amount of money is expended on street lighting which could be made to bring a higher return. There are still a number of places where the automatic control system has not been adopted, and one can scarcely understand why this method has not been applied throughout the whole of the country.

I have purposely refrained from dealing with technicalities of apparatus or organisation in my remarks, for while I believe that the importance of the highest possible standard of these cannot be over estimated, I wish to suggest that it is good to get the lamps and the lamp lighting out of our own "line of vision" sometimes, and to look round the field of our activities (which is far wider than we often realise) and to imagine (extravagantly if you like) what could be done, and to think wisely and carefully what can be done, and then to press forward to its realisation.

The president was thanked for his address on the motion of Mr. A. C. Cramb (Croydon); this was seconded by Mr. J. F. Colquhoun (Sheffield), who presented the following paper.

The Improved Lighting of Sheffield.

By J. F. COLQUHOUN.

(*Abstract.*)

The President and Council have suggested to me that a statement of the work involved in improving the street lighting of Sheffield would be interesting to the members of the Institution of Public Lighting Engineers. In order to understand the steps subsequently taken it will be necessary to give some indication of the position as I found it on my appointment as Lighting Engineer of the city in May, 1924. As you know, the price of gas in Sheffield is amongst the lowest in the country. Before the war it was as low as 10d. per 1,000 cu. ft. for street lighting purposes, and because of this a more generous use was made of gas in Sheffield than in most places in the days of flat-flame lighting. There were in use 11,112 gas lamps, almost all consuming 4 cu. ft. of gas per hour, and 287 electric lamps with wattages ranging from 60 to 500.

In reviewing the situation, I came to the conclusion that it would be unwise to propose to the Lighting Committee any large lighting scheme involving a considerable expenditure of money.

The charges made by the Electric Supply Department against the Street Lighting Department were, to my mind, high. My arguments for better terms were considered in a reasonable and sympathetic manner, and in July I was able to report to my Committee a reduction of over 25 per cent. in the cost of electric street lighting. Considerable economies were made in the administration of the Department, and it was found possible to do more than was at first expected with the funds at our disposal. By May 1st, 1926, in addition to the gas lamps re-lighted, 714 new gas lamps had been erected and the number of electric street lamps had increased from 287 to 1,015, a total increase of 2,697 street lamps used in the lighting of the city in two years.

On May 1st, 1926, Sheffield was lighted by 1,015 electric lamps, ranging from 60 W to 1,000 W, and 13,081 gas lamps, ranging from 3.5 cu. ft. consumption per hour to 16 cu. ft. per hour.

Owing to the rapid increase in the number of lamps in use, rearrangements of the districts which each lamplighter looked after had constantly to be carried out. In this connection we found the use of automatic clock controllers invaluable and there are now 800 gas lamps and 682 electric lamps so con-

trolled. For the lighting of the large housing scheme, the Electric Supply Department incorporates in its main supply a switch wire for street-lighting purposes. The switch points are brought on to a road running through the centre of the scheme and 400 lamps can be hand-controlled within twenty minutes' walking distance from the first to the last switch. Each switch controls on an average 40 lamps. The lamps, however, are now controlled by time switches. The system has proved satisfactory and a switch wire is now being incorporated in all new cables laid for immediate or future use. The efficient maintenance of the lamps, *i.e.*, cleaning of the lanterns and burners, fitting mantles and electric bulbs, clearing services, &c., called for some careful consideration. There was formerly a special maintenance staff who replaced broken mantles, cleaned and adjusted burners when defects were reported by the lighting staff.

In an endeavour to increase the interest in, and knowledge of, their duties, and in consequence to increase the pleasure and the satisfaction of the men in their work, the Sheffield Illumination Society was founded in October, 1924. Every employé of the Lighting Department is eligible for membership, and a small annual subscription of 5s. is taken to cover running expenses. To show its interest in the Society the City Council makes an annual grant of £15. So far, the Society has been very successful, and to its influence I attribute in no small degree the undoubted enthusiasm in the work of the Lighting Department which the majority of the staff now display.

In Saville Street and Attercliffe Road, various forms and makes of lanterns are used, housing 500-W gasfilled lamps. This thoroughfare is in the industrial part of Sheffield, and while the test is not yet quite completed, it is evident that the efficiency of prismatic glassware is impaired by the rapidity with which these fittings become dirty in an industrial area. Within a fortnight the increased intensity of light on the roadway and footpath by the use of such directive glassware is lost. Various forms of 2-way directive units are used.

A lighting scheme at Change Alley agreed on by the shopkeepers and the Lighting Department, comprises six 500-W "Wembley" lanterns suspended on cross wires. The point of light is 17 feet high, and the lamps are spaced 17 yards apart. Four lamps are maintained by the shopkeepers and two by the Lighting Department. The lamps for which the shopkeepers are responsible are extinguished by time switch. At present we are dealing with the lighting of the principal thoroughfare in the city, fitting 1,000-W gasfilled lamps 25 feet high on bracket arms on tramway poles. The poles are fairly evenly spaced and 50 lamps will be used to light 1,550 yards of roadway, excluding those portions of side streets lighted by the lamps erected in the main thoroughfare. They will be controlled by time switches and each alternate lamp will be extinguished at midnight. We also hope to erect 50 additional 500-watt gasfilled lamps and increase the number of 4-light gas-burner lamps on the tramway and 'bus routes and other busy streets during the present financial year. The estimates of the Department have been fixed at £65,000 for the present financial year, representing a 6¾d. rate on the present valuation of the city, or about 1d. per week, per head of the population; this can hardly be called extravagant expenditure on street lighting.

But the cost per head of the population does not form a reliable comparison. It is obviously absurd to compare the cost of the lighting of the City of London, for instance, with that of a provincial town of approximately 13,000 inhabitants, and I know of no one satisfactory standard of comparison. What is an appropriate sum to spend on public lighting must be considered by the requirements of each area, but I think it must be admitted that the lighting of our cities and towns generally does not meet the requirements of the case. It is scarcely possible to over-estimate the value of a well-lighted route to the vehicle drivers, the lessening of strain, and the minimising of danger from accident.

Is it not incumbent on each member of this Institution fully to realise modern requirements in street lighting, to visualise the requirements of the future, and to endeavour to get the authority which he serves so to realise them that a standard of street illumination may be provided which will allow us worthily to carry the responsibility, legally or otherwise, placed on us?

Discussion on Mr. Colquhoun's Paper.

Mr. LANGLANDS (Glasgow) said that Mr. Colquhoun had had an uphill job to improve the lighting of Sheffield. The prominent thing in all lighting schemes was that it depended upon the terms that could be obtained for the supply of gas or electricity. There was a wide difference in the prevailing conditions all over the country. Some places recognised that public lighting was the best advertisement that a town could have. In Glasgow, when the committee objected to improvements, he pointed out that before gas or electric lighting there was a 6d. rate for oil illumination, as compared with a possible 1d. rate for gas. In the electric department the bugbear was cabling. The cost of generating might be 40 per cent., and the cost of distribution 60 per cent., and to get their supplies they came under the 60 per cent. and, therefore, there was difficulty in meeting the charges.

Mr. F. P. TARRATT (Newcastle and Gateshead Gas Co.) said there would be no trouble from glare if the lamps were properly placed and the light spread evenly throughout the lantern.

Mr. SHAKLEY said that Mr. Colquhoun had only touched the fringe of the question, and he would have liked him to have given more about the improvements. The council at Bradford had considered that there was so much room for improvement that Mr. Colquhoun had been called in to advise them in that city, which had been described as one of the darkest in the West Riding of Yorkshire.

Mr. BRANSTON said that in South Shields they were endeavouring to get Government assistance for a scheme of rearrangement for the public lighting.

Mr. LEON GASTER (London) said that when the Institution was formed it was not generally encouraged by the corporations, but it was now making itself felt. Mr. Colquhoun showed how he had adapted himself to making improvements, and that was an important point.

Mr. THOMAS NEWTON (Hereford) said that the author seemed to aim at a minimum of space between the standards. He thought it would be a better method if the streets had been classified and then a standard of illumination obtained for each; the difficulty seemed to be that they had not got uniformity.

Alderman DAVEY (Greenock) said that amongst other improvements in his town they had 2,000-c.p. lamps, 25 ft. high. On the new housing-scheme roads, 500- and 300-c.p. lamps had been installed. They had adopted the wave system which cost £8,000 to install, but they were saving £2,000 a year.

Mr. COLQUHOUN in reply expressed the opinion that the standard of lighting for arterial roads should be such that motor-cars could do without headlights.

Motor Traffic.

A PAPER was read by Mr. Edward Fryer (Deputy Secretary, Automobile Association) on Motor Traffic, with especial reference to lighting on the highway and on the vehicle. After reviewing the situation, the author pointed out that there was no compulsion on a lighting authority to provide efficient street lighting—it was permissive. He suggested that they would not get satisfactory highway illumination without some measure of compulsion. On the other hand, they could not ask for compelling legislation until public opinion had been educated to require a minimum standard. It would be unfair to take any portion of the motorist's money for highway illumination unless they had a guarantee that the lighting provided would enable the motorist to proceed without powerful headlights. For the purpose of carrying out experiments, so as to arrive at practical results, he saw no reason why advantage should not be taken of Section 6 of the Roads Improvement Act, 1925, which gave all that was required at the moment. He recommended that the City Council of Newcastle should be asked by the Conference to apply to the Minister of Transport for authority to conduct initial experiments, and that, when the results justified it, that the experiment should be carried along the Great North Road as far as Morpeth, at the cost of the Road Fund.

Either the local authority or the motorist should have to provide sufficient illumination to render travel safe. To-day the motorist provided sufficient for his own needs, the highway authority had to light obstructions, the lighting authority provided what it considered sufficient—and in many cases not even that. If they continued on this basis, the time might come when most road-users—including pedestrians, but excepting policemen and criminals—would be carrying their own headlights: a terrible prospect!

Discussion on Mr. Fryer's Paper.

Mr. BALMFORTH (Bingley) thought that if the Automobile Association reported to councils about main roads that were badly lighted, he felt sure they would get better lighting.

Mr. LEON GASTER (London) argued that the lighting of the main roads should be the responsibility of the Ministry of Transport. If that body accepted the responsibility of making roads, they should also see to the lighting.

Mr. SHAKLEY (Leeds) contended that the Automobile Association was trying to shelve some of its responsibilities. As an Institution they were not going to be dictated to by the Automobile Association. The Institution was going to throw a certain amount of responsibility on the Association. The lighting of roads so that motors could do without headlights was all right, but when it came to the main roads away from the town it was an impracticable proposition.

Mr. T. NEWTON contended that the lighting of the highways so as to do away with motor headlights was more an ideal than a practical proposition. They should make the towns and cities safe before they began shouting about the illumination of the highways and byways.

Mr. FRYER, in closing the discussion, pointed out that the Automobile Association was doing its part in erecting signs and such like.

Mr. Beveridge next presented a paper on "Lighting Hours."

Lighting Hours.

By R. BEVERIDGE. – (*Abstract.*)

When our Institution came into existence, and when others were concerning themselves for its welfare by thinking of the problem of its nourishment, I began casting round for some form of employment on which to develop its youthful vigour and raised the question of lighting hours. A small Committee conducted an inquiry into the procedure followed in all the larger towns and reported that the outstanding feature of the information collected was the diversity in the prevailing practice. It was not considered advisable at that stage to make any attempt to devise a formula which could be recommended for general adoption, subject to geographical corrections, and the Council, when receiving its report, confirmed the view that the subject ought to be further ventilated.

In London, where there are many different local authorities, there are different time schedules just as there are different ideas about other lighting matters.

By hand control there is nominally one hour's lighting to be paid for daily in excess of the period over which full lighting is actually provided.

I do not suggest a schedule which would be applicable to all towns; but we could have a table which would represent the minimum lighting hours for, say Greenwich, because the geographical corrections could be the more easily effected. These minimum lighting hours would assume simultaneous operation and would have regard to the seasonal influence on twilight and dawn. If it did nothing else it would furnish a useful datum line by which one town could be judged as being generous or otherwise in the margin it allowed as compared with another without the complication caused by the allowance of time for lighting. It would also establish a recognised schedule for the timing of mechanical controllers, bringing the use of such apparatus into its proper place in the scheme of public lighting.

Discussion.

Mr. WINSTON (London) said often in London lamps on one side of the street would be lighted when those on the other were not, the reason being that they were in two different areas. The only solution was to have a standard time-table.

Mr. COLQUHOUN asked, assuming there was legislation on the time of lighting, to whom was it to apply? How would it apply to the industrial areas where the atmospheric conditions were such as to require lighting at an earlier hour than fixed by statute? There would have to be some saving clause.

Mr. STEWART (Glasgow) agreed with having a standard time, but he did not favour an Act of Parliament. They were working to a scale in Glasgow, but at times it would be found necessary to depart from it. Traffic was a factor to be considered, and geographical position and conditions of climate would also enter into the question of lighting hours.

Mr. JONES (London) said the whole question depended upon the degree of visibility obtaining.

Mr. BEVERIDGE, in replying, expressed the opinion that a quarter of an hour after sunset would be a sufficient margin for the country, but the uncertainty of the weather they could not control. He did not suggest that there should be any more legislation on the question than there was at the present time.

(To be concluded.)

Legal.

Removal and Theft of Cable.

WM. SCALES, a hawker, was charged at Rotherham recently with the theft of copper cable valued at £40 and with receiving 84 lb. of cable, the property of Messrs. Newton Chambers and Co., Bradgate Colliery, Rotherham. Running from the colliery was a series of nine poles carrying h.p. cables to a drift. Recently the whole of the two cables, about 780 yd. long, was cut down and removed, and considerable damage was done to the poles and terminals. Subsequently accused was seen to attempt to sell some copper cable at a scrap yard. For the defence it was stated that Scales found the cable in a hedge, and thinking it was scrap attempted to sell it. He was found guilty of receiving, and was sentenced to three months' hard labour.

Fraudulent Consumption of Electricity.

AT Twickenham on September 16th, Kathleen Higney, proprietress of a nursing home, was charged with the fraudulent abstraction of electricity from the mains of the Twickenham and Teddington Electric Supply Co., Ltd. It was stated that one of the company's inspectors visited defendant's premises and found that a wire had been connected on the company's side of the meter so that electricity entering the premises was not recorded. The defendant was warned, but failed to rectify the matter. It was also stated that she attempted to bribe the inspector. The defendant was found guilty and fined £5.

A Successful Suggestion Scheme.—During August 403 "Suggestions" were made by the staff of London's Underground to the management, and of these 24 are to be adopted. In addition to the foregoing three special awards have been made to a driver, a guard, and a 'bus conductor, in recognition of the number of suggestions made by them during the past two or three years, which have been accepted or adopted.

An Electric Trolley Omnibus.

The First of Three A.E.C. Vehicles for Bradford City.

THE first of three electric trolley omnibuses ordered by the Bradford Corporation Tramway Department, of which Mr. R. H. Wilkinson, M.Inst.T., is the general manager and engineer, has just been delivered to the city authorities by the Associated Daimler Co., Ltd. (Associated Equipment Co., Ltd.).

It is an interesting vehicle from several points of view, as the accompanying illustration and details will show, and a similar 'bus was sent to Liverpool for demonstration purposes from September 6th to 11th, and during the meeting of the Municipal Tramways Association.

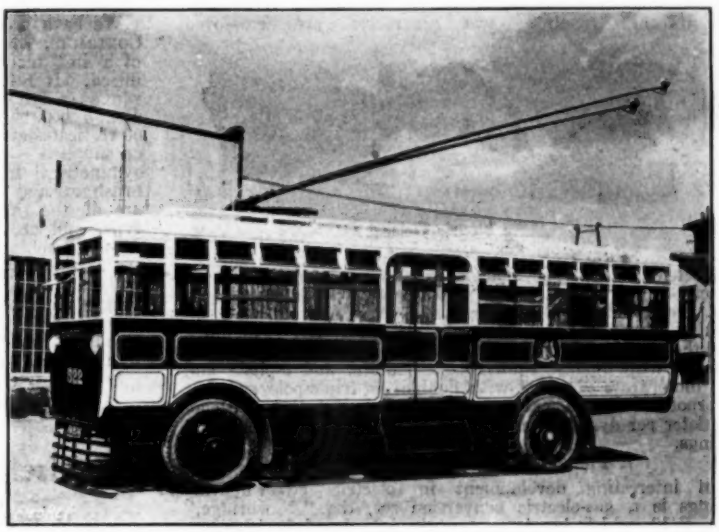


Fig. 1.—An A.E.C. Omnibus for Bradford City.

As fig. 1 indicates, it is a single-deck 'bus with a side entrance at the middle, being an A.E.C. model 607 with a capacity of 36 seats, and capable of attaining a speed of 28 m.p.h. when fully laden. The side members are of pressed-steel channel section, parallel from end to end; the front axle is an I-section steel stamping and the rear one is a nickel-steel drop forging with an underslung worm drive; 38-in. by 7-in. twin pneumatic tires are fitted and the vehicle's main dimensions are:—

Wheel base	14 ft. 6 in.
Track front axle	6 ft. 4 in.
Track rear axle	6 ft. 1½ in.
Frame length overall	25 ft. 10 in.
Frame length behind rear axle	7 ft. 2 in.

Internal expanding brakes on all four wheels are operated on the Westinghouse air system, and internal expanding brakes on the rear wheels operated by a hand lever, while an external expanding brake for emergency use has been provided on the transmission shaft at the rear of the motor, operated by a foot pedal placed to the left of the controller pedal and operated by the same (left) foot. A tubular cardan shaft between the motor and rear axle is fitted with universal joints at each end, of the Spicer type, enclosed in dustproof and grease-tight cases.

The "Bull" traction motor made by Messrs. E. R. & F. Turner, Ltd., is rated at 55 h.p. at 1,030 r.p.m., in accordance with the British Standard Specification 173—1923, and is of the ventilated and interpole type. An E.M.B. Type T, foot-operated controller is used, arranged with 5 plain series accelerating notches and operated in conjunction with an A.E.C. patent governor device for automatically shunting the field current by means of a governor and a contactor. The field of the motor is automatically diverted by 33⅓ per cent. at a speed of 16 m.p.h., and by 50 per cent. on the last notch of the controller. An E.M.B. "unbreakable" jointless and rustless grid-type resistance is included, and the 'bus is fitted with a trolley pole deviation indicator, a device invented by Mr. Wilkinson, of Bradford; also with an electric horn, a foot gong, electric wind-screen wiper, and a speedometer.

Lloyd's Register of Shipping.—We have received a copy of the report of the Society's operations for the year 1925-26. During the year the committee passed plans for 361 new vessels, representing a gross tonnage of 1,089,360. Steam turbines were fitted in 14 new vessels of 146,354 tons gross; in this figure is included one vessel (s.s. *Itiyo Maru*, 4,274 tons) in which the turbo-electric drive is employed. The turbines are in each case associated with reduction gearing, in ten of the vessels the single-reduction type being employed, and in the remainder the double-reduction type.

New Electrical Devices, Fittings and Plant.

(Readers are invited to submit particulars of new or improved devices and apparatus.)

An Electric Welding Set.

We have received some particulars of a new electric welding generator set which has been designed by the ELECTRICAL EQUIPMENT & CARBON CO., LTD., 109, New Oxford Street, London, W.C.1, for low-pressure working. The arc-welding current is supplied by a special dynamo of the self-exciting type. No additional resistances, field rheostats or choke coils, it is claimed, are required, and the voltage automatically adjusts itself to the value necessary for the maintenance of the arc at constant current, resulting in the machine being subjected to a minimum interruption. For cases where large currents are required, two generators are employed

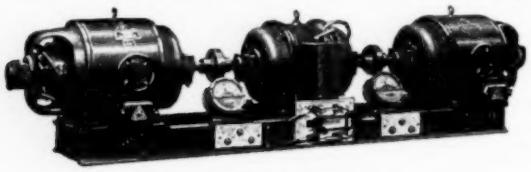
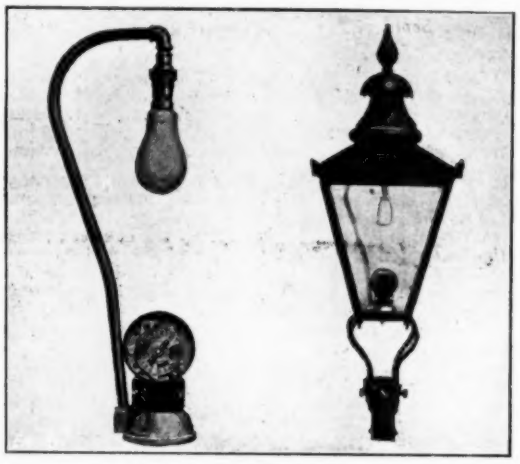


Fig. 1.—An Electric Welding Set.

connected in parallel and driven by a centrally-placed directly-coupled motor, on a common bed-plate, fig. 1. For street use the set can be supplied mounted on a suitable cart or truck. A non-automatic starter is mounted on the motor frame. Star-delta starters are supplied for use with 3-phase squirrel-cage motors, and 3-phase and d.c. motors are provided with double- or triple-pole switches incorporated in the starters. Each set is supplied with an ammeter per dynamo and the necessary connecting leads and fittings.

A Public Lighting Conversion Unit.

An interesting development in electric street-lighting fittings is a gas-electric conversion set, the "Newbridge," type F/10, which has been recently introduced for the conversion of gas-type lanterns for electric lighting, by the Horstmann Gear Co., Ltd., Newbridge Works, Bath. The set, fig. 2, consists of a 15- or 30-day, 1.5-A time switch mounted on a small base attached to which is a tubular swan-neck fitted with a lamp holder. The base is equipped with plug sockets, which either accommodate plug terminals carried at the bottom of the time switch in an ebonite terminal block, or, for group or continuous lighting, a bridge fuse with similar



Figs. 2 and 3.—Gas Lamp Conversion Fitting.

terminals. When the time switch is in use the fuse bridge provides a s.p. fuse in circuit, plug sockets at the back of the terminal block accommodating the bridge. The base plate of the fitting is drilled and threaded for easy fixing to the connecting pipe in the lantern. The bracket and base are of aluminium, and the fitting is wired with twin cab-tire cable. The base plate fully protects the terminals, which are well insulated and arranged for convenient connection to the supply leads. The time switch is fitted with a very neat make-and-break mechanism situated behind the dial of the clock; the clock is housed in a rust-proofed steel case. The overall height of the standard model is 19 in. Fig. 3 shows the unit installed in a gas-type lantern.

A New Design of Rotary Pump Gear.

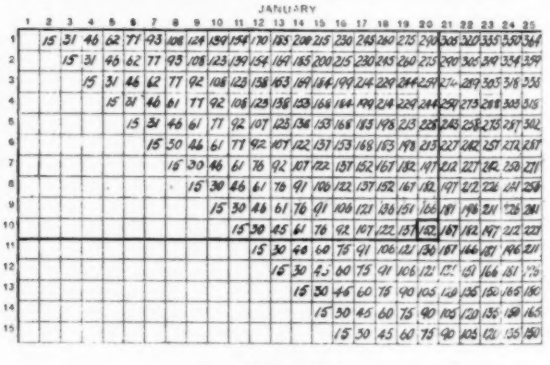
A departure from the usual design of rotary pump is represented by the development of a new form of tooth for the gear wheels by MESSRS. DAVID BROWN & SONS (HUDDFD.), LTD., Park Works, Lockwood, Huddersfield. This new gear, the "Roloid," differs from the usual type of conventional involute gear, it is claimed, in having a greatly reduced sliding and increased rolling action between the teeth, brought about by a patented profile. An important feature of the gearing permitted by the new design of tooth is a reduction in the number of teeth per wheel, which leads to an increased delivery for a given size of pump, or, alternatively, to a reduction in the pump dimensions and cost for a given delivery. This advantage is secured by the reduction of the number of teeth to a minimum combined with maximum depth of tooth.

Range of Improved Small Motors.

We have received some information from MESSRS. POWER CONTRACTS, LTD., 138-140, Southwark Street, London, S.E.1, of a 1926 model "Batwin" motor which they have introduced. It retains the features of the 1924 model, but its range is extended considerably, covering from ¼ to 3 h.p. d.c., 5 h.p. single-phase, and 7 h.p. polyphase. A range of vertical-shaft machines is included. The d.c. machines can be supplied either shunt or compound wound. A substantial symmetrical iron frame provides good accessibility to both brushgear and bearings. In the ¼ to 1½ h.p. sizes the bearings are of the self-aligning, removable, phosphor-bronze sleeve type, and are lubricated by a patented dual-wick system. All the machines are fan ventilated. The single-phase motors are of the repulsion-induction type. It is claimed that they will start on 70 per cent. of the line voltage and exert 550 per cent. of the rated load torque with only 250 per cent. rated load current. The polyphase motors are designed for high-starting torque. They develop not less than 200 per cent. of the rated load torque at normal voltage and frequency.

A Useful Street Lighting Table.

MR. S. G. BUDD, of the Westminster Electric Supply Corporation, Ltd., has compiled a table by which it is possible to read off readily the number of hours that a street lighting lamp has been "on circuit" up to any particular time, the date of its initial installation being known. The statistical information given by the table is based on the usual sunrise and sunset hours, so as to give a general approximate value. The table is arranged in twelve sheets, one for each month of the year. We reproduce herewith a portion of the January sheet; the thick lines depict the method of reading off the desired value. The number of hours "run" by a lamp installed on January 10th up to and including January 20th is 152 as indicated at the junction of the vertical dropped from



Street Lighting Table.

January 20th and the horizontal drawn from the fixing date, January 10th. The burning hours are worked out up to a total of 800, as representing the average guaranteed life of a 500-W lamp. This device should prove a considerable time saver to those engineers who have contracts with the lamp manufacturers based on the life of the lamp installed.

A 104,000-kW Turbo-Generator.—An order for a steam turbo-generator of 104,000 kW has been placed with the Westinghouse Electric and Manufacturing Company by the Commonwealth Edison Company (America). The new set is to be installed at the Crawford Avenue generating station, bringing the total capacity of the latter up to about 450,000 kW. The turbine will operate with steam at 550 lb. gauge pressure, a temperature of 720 deg. F., and a 29-in. vacuum. The size of the turbine may be visualised by considering that its shipping weight will be approximately two and one-half million lb. A huge freight train will be required to carry the various parts from the respective works to the power station.

Correspondence.

Correspondents should forward their communications **at the earliest possible moment.** *No letter can be published unless we have the writer's name and address in our possession.*

Wireless Trade Organisation.

The W.R.A. wish to be among the first to congratulate the manufacturers on the successful issue of their protracted efforts to form a comprehensive union, resulting in the Radio Manufacturers' Association. As is well known, retailers in general have always favoured the policy of "One Association for each section of the Trade," and they will feel that an important step on the road to efficient organisation has at last been taken.

It now remains for dealers to realise the necessity of following this excellent lead and of similarly consolidating themselves in one representative organisation. Such an Association can then voice their collective views and so facilitate negotiation and co-operation with the Radio Manufacturers' Association in solving many difficult problems which could not otherwise be dealt with.

The W.R.A., which was formed between three and four years ago for the purpose of representing the interests of dealers, welcomes to its ranks all *bona-fide* retailers who can satisfy the Council that the conditions of membership are fulfilled. Its aims and objects are too well known to call for any recapitulation here, but, should there be any traders who are not familiar with them, full particulars will be sent on application.

The point which should be clearly and widely appreciated by retailers is that the new Association, which represents the great bulk of the manufacturers in the trade, has no section for retailers, but looks to retailers to organise themselves. All responsible and *bona-fide* dealers who desire to see such problems as price-cutting and what is known as "dabbling," &c., dealt with in the one way which offers any certainty of effective results will therefore recognise the advantages to be reaped from membership of the W.R.A., which remains, as it has always been, the only Association *solely* representing the interests of retailers, and which has the goodwill of all the influential manufacturing firms with which it has come into contact.

Wireless Retailers' Association of Gt. Britain.
p.p. CLIFFORD & CLIFFORD,
Hon. Secretaries.

London, *September 16th*, 1926.

The B.E.S.A. Glossary.

The last paragraph of your note on this subject in your issue of August 27th is an invitation to discuss further the points at issue between Professor Howe and the B.E.S.A. Panels. Most engineers and most physicists form mental pictures of the mechanism of the phenomena with which they are dealing, and these mental pictures are often the inspiration leading to great advances. There must always, however, be a distinction between the mental pictures on the one hand and the basic experimental observations and the logical deductions therefrom on the other. Professor Howe holds the view, apparently, that in the cases of the electric and magnetic fields, certain mental pictures, usually attributed to Faraday and Maxwell, should be regarded as logical deductions and as such should be incorporated in the definitions of the fluxes. But neither Faraday nor Maxwell built any logical arguments on their mental pictures. The strict logic of Maxwell's treatise is based on the experimental laws and is independent of whether the electric field is a "cause" and induction an "effect," whether "action at a distance" is possible or whether the æther exists or not. All recent developments confirm the fundamental principles of electricity and magnetism as natural laws, the exact mechanism of which may not be humanly understandable. It is possible, therefore, that Professor Howe's sweeping criticisms are not as fully justified as he imagines.

In the course of the discussion Professor Bailey supported Professor Howe on the ground that the storage of energy in the field involved both the idea of a field strength and the idea of induction. This view has been put forward frequently, but careful consideration shows that it is purely a convention because in point of fact it is not known how the energy is stored. The amount of energy stored is known and this may be expressed in terms of either the field strength, the induction, or the product of the two—whichever happens to be the most convenient.

With regard to the unit tube of electric force, Professor Cramp and others pointed out that Professor Howe's unit is not that generally employed, and turning merely to the books that I happen to have at hand at the moment I find the B.E.S.A. unit is the same as that used by Campbell, Carey-Foster, Eccles, Jeans, Porter, Poynting, Russell, Thomson, and the Dictionary of Physics. The only alternative system is the one proposed by Heaviside in which a "$1/4\pi$" is introduced in the expression of the law of force between electric and magnetic quantities. This system has been used to only a very limited extent—for example, by Richardson in this country and Barnett in America.

C. L. Fortescue.

City and Guilds (Engineering) College, London.
September 16th, 1926.

A Defence of the Poor Manufacturer: A Reply.

In reply to Mr. A. J. Smith's article (ELEC. REV., September 17th, p. 458) it is said that any fool can make goods, but it takes a clever man to sell them. This axiom is laid down by many a sales expert, and, like all general statements, has a grain of truth and common-sense in it. The man who is busy making goods has not time to make himself cognisant with the latest methods of getting rid of them, once made.

Every man to his trade; a born maker cannot be a born seller. What does the manufacturer know about the cost per reply of certain styles of advertisements in certain journals, on certain pages, and on certain spaces on those pages? What does he know about population density, allocation of expenditure in various weekly budgets, the mind and psychology of the lady of the house, the spender of the family? Surrounded by the four walls of his factory, his goods loom large in his estimation. Once they get out into the great big competitive world, they look very small. His outlook is blinded by the size and value, in his estimation, of what he creates from a mass of raw material. He cannot come down to cold hard facts. The fact is that nobody wants your goods, Mr. Manufacturer, and you must employ someone to get rid of them who is an expert in doing so. The sales expert is a counsellor with long experience in preparing advertisements, selecting right journals, and in sales promotion in general. If manufacturers had to sell their own products in these competitive times unaided by people who have made a study of selling, they would soon find themselves in the place of the man who made the best mouse-traps in the world and lived in a forest. He still lives there, and there is *no* beaten path to his door. A manufacturer cannot see the goods he makes in their true light—they are his children, his gods. Outside the factory, however, they are just one motor amongst many, or one bell amongst many, and from being THE they become A. A salesman puts the goods on their proper footing and sells them as they are, not as they appear to be. It is true that the man who knows least about markets, advertising, and salesmanship, distribution, publicity, and sales promotion in general, is the manufacturer. How can he know? He has not the facilities for finding out. Any manufacturer who does know to-day has had a sales expert to tell him and guide him. Who really sells the manufacturer's goods? The retailer. It is the retailer who has to be watched and nursed for his goodwill and co-operation. The sales expert knows how to do this; does the manufacturer? Did anyone ever hear of a manufacturer designing an attractive and sales-compelling package or container for his product?

Is a manufacturer capable of finding the right salesmen? Does he know anything about window dressing? Can he write copy about his product which would bring orders?

The answer is in the negative; let the cobbler stick to his last.

R. E. H. Lovelace.

Edgware, *September 20th*, 1926.

Employés in Generating Stations.

In last week's issue of the ELECTRICAL REVIEW there appeared an advertisement for a "fireman wanted"; it is to be hoped the advertiser gets the right kind of "fireman."

In boiler houses, where the controls depend entirely on the human element, it is essential to maximum efficiency that the firemen be competent, conscientious, and ambitious. The same applies to all employés, and only the best men obtainable should be chosen to fill the various positions.

All vacancies should be advertised and the men appointed by their abilities to improve the industry, and not because of long service, influence, &c.

There is something every employé in a power station can do in his own department to help to reduce the cost per unit generated and so lead to an increased output, followed by an increase in wages.

If each man did his best to raise the efficiency of his station instead of simply trying to make or keep his job a soft one, he would be practising the principles of a true British working man.

The E.P.E.A. schedule provides for the wages of the technical staff to vary according to the units generated, and not to the length of service or efficiency of the individual. If he is not efficient and will not become so, then he has no right to hold his position; his employers will or should see to that.

Let every employé strive to increase and meet the demand for electricity; then there will be harmony with the joys of a flourishing industry.

W. H. Robertson.

Kirkcaldy.
September 17th, 1926.

A Thermal Storage Cooker.

I noted with interest your leading article of September 17th, and the description by Mr. R. Borlase Matthews of a fireless cooker system used at Stockholm. The enclosed block of the Campbell cooker which the enterprising U.S.A. manufacturers sent to me, unasked, with a consignment of cookers, may perhaps interest your readers. The fireless-cooker principle is embodied in the bottom (boiling) chamber. The time-saving features of the Stockholm cooker are achieved in this one. The "boiler" chamber has a cut-off switch thermostat operated by the steam issuing through a ¼-in. diameter hole, and

the lagging is so good that stewing, &c., can go on for an hour or so after the electricity is cut off. The oven is also thermostat operated, but in this case the current is automatically switched both on and off to maintain a regulatable issue of steam.

A pleasing feature from our point of view is that the maximum demand is limited—two electric iron contact fittings and cords being provided for operation instead of switches.

It may be mentioned that this cooker is no more expensive than the standard cast-iron cooker, but it is certainly more efficient, as the wasteful open boiling is reduced to a minimum. The cooker is a pleasing article of furniture, suitable for a kitchen instead of the scullery; it is portable (runs on wheels) and does not look like a gas stove. We have a number in use giving satisfaction on a.c. On d.c. 220 V the oven thermostat switch does not always "break" properly, but the American standard voltage is only 110, and the switch will no doubt be altered for d.c. 220-250 V if there is sufficient demand.

An American Cooker.

A complete equipment of special aluminium utensils is sent, included in the price of the stove, so that there are no "extras."

Until I can find a British article to equal it we have no alternative but to put this forward on a.c. for a house with a family of five; in fact, for all the uses for which the standard British hiring cooker is suitable.

W. Fennell,
General Manager and Engineer.
Mid-Cheshire Electricity Supply Co., Ltd.,
Northwich, Cheshire.
September 20th, 1926.

Trade-Mark Applications.

THE following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from September 15th :—

Formo. No. 469,381. Class 8. Condensers, rheostats, capacity couplers, transformers, tuning recording dials, jack plugs and portable aerials, all being goods for use in wireless telephony.—Arthur Preen & Co., Ltd., 22, Cricklewood Lane, N.W.2.

Scriptograph. No. 471,229. Class 8. Electric projection apparatus for advertising purposes.—The David Allen Scriptograph Co., Ltd., 1, Wardour Street, W.1.

Viaduct. No. 471,500. Class 8. Philosophical and scientific instruments and apparatus for useful purposes.—Bruno L. Lion, 10, Raven Court, Alexandra Road, Westcliff, Essex.

Duvarileak. Duvolcon. Duwirohm. No. 471,935. No. 471,936. No. 471,397. All goods in Class 8.—Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, W.3.

Anchorlite. No. 471,442. Class 13. Electric reading lamps.—Peyton, Hoyland & Barber, Ltd., Bordesley Works, High Street, Bordesley, Birmingham.

Rely-A-Bell. No. 466,004. Class 18. Electric burglar and fire alarm installations.—The Rely-A-Bell Burglar and Fire Alarm Co., Ltd., 42a, Wilson Street, Finsbury, E.C.2.

Ivorant. No. 471,342. Class 50. Electric-insulating compositions.—Ward and Goldstone, Ltd., Sampson Works, Frederick Road, Pendleton, Manchester.

New French Steam-Pressure Unit.—A new series of regulations governing the installation of steam boiler plant in industrial establishments has recently come into operation in France. In addition to extending the powers of steam users' associations, it revises the scale of test overloads and provides that in future steam boiler pressures will be denoted by a new unit, the "hectopieze," which is equal to 1.02 kg. per sq. cm., or approximately 14.5 lb. per sq. in. In applying the regulations it is pointed out that the effective steam pressure will not be the actual pressure on the walls of a steam boiler, but the difference between that pressure and the atmospheric pressure on the exterior of such walls.

Published Specifications.

Compiled expressly for this journal by patent agents. The name of the applicant's patent agent, if any, will be found on the printed specification. The numbers in parentheses are those under which the specification will be printed and abridged, and all subsequent proceedings will be taken.

1925.

5,122. "Reproduction of pictures, drawings, and other representations by the aid of telegraphy." Creed & Co., Ltd., and F. G. Creed. February 24th, 1925. (257,013.)

5,225. "Thermionic amplifying apparatus." Atwater Kent Manufacturing Co. July 26th, 1924. (237,553.)

5,523. "Method of and apparatus for determining and indicating electrically the presence, position, or properties of bodies." Soc. Leroy, Lajoux & Cie. March 1st, 1924. (230,095.)

8,241. "Telephone systems." Siemens Bros. & Co., Ltd., and E. J. C. Rousseau. March 27th, 1925. (257,302.)

8,499. "Current rectifying devices." Westinghouse Brake & Saxby Signal Co., Ltd. (Union Switch & Signal Co.). March 30th, 1925. (257,305.)

8,589. "Telephone exchange systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.) (L. Polinkowsky). March 31st, 1925. (257,307.)

10,403. "Telephone transmitters." E. A. Graham (deceased) and L. H. Paddle. April 21st, 1925. (Cognate application 22,651/25.) (257,309.)

10,719. "Submarine signalling apparatus." Submarine Signal Corporation. January 23rd, 1925. (246,431.)

10,798. "Automatic and semi-automatic telephone systems." Siemens Bros. and Co., Ltd., and H. E. Humphries. April 25th, 1925. (257,310.)

11,279. "Devices for emitting or receiving sound." N. W. McLachlan. April 30th, 1925. (Cognate application 16,139/25.) (257,317.)

12,427. "Electric switches." Brookhirst Switchgear, Ltd., and J. A. Hirst. May 13th, 1925. (257,562.)

13,485. "Instantaneous electric control of a beam of light." Dr. A. Karolus. June 20th, 1924. (235,857.)

13,658. "Electrotherapeutic apparatus." P. Parry and D. H. Brayne. May 25th, 1925. (257,327.)

13,769. "Telephone systems." Automatic Telephone Manufacturing Co., Ltd., and W. Saville. May 26th, 1925. (257,329.)

13,885. "Rotor-fed compensated asynchronous machines." Sachsenwerk Licht-und-Kraft Akt. Ges. August 18th, 1924. (238,514.)

13,936. "Adjustable inductances." J. S. E. Townsend. May 27th, 1925. (257,334.)

14,030. "Electric vibratory relays." British Thomson-Houston Co., Ltd., H. S. Petch, and P. H. Harding. May 28th, 1925. (257,337.)

14,039. "Polarised relays." Automatic Telephone Manufacturing Co., Ltd., and S. R. Smith. May 28th, 1925. (257,339.)

14,068. "Loud speakers." S. L. Price. May 28th, 1925. (257,341.)

14,094. "Multiple electric connector." G. L. Woodward. May 29th, 1925. (257,342.)

14,210. "Automatic and semi-automatic telephone systems." Standard Telephones & Cables, Ltd. (formerly Western Electric Co., Ltd.), H. J. Herink, A. M. Searle, and J. H. E. Baker. May 29th, 1925. (257,349.)

14,574. "Dirigible headlights for automobiles." A. T. Nyblom. June 4th, 1925. (257,354.)

14,799. "Electric arc welding." Sir B. Longbottom and E. Greenhalgh. June 8th, 1925. (257,357.)

14,857. "Radio receiving apparatus." Hazeltine Corporation. April 3rd, 1925. (250,162.)

15,006. "Electric transformers." British Thomson-Houston Co., Ltd., and J. G. Wellings. June 9th, 1925. (257,360.)

15,238. "Friction vernier adjustment devices for wireless apparatus and the like." T. E. Williams. June 12th, 1925. (Cognate application 21,279/25.) (257,364.)

15,293. "Electric transformers." British Thomson-Houston Co., Ltd., and J. Hutt. June 12th, 1925. (257,365.)

15,388. "Variable electric condensers." W. J. Rickets. June 13th, 1925. (257,367.)

17,022. "Reversible rotary electric switches." C. Oliver. July 2nd, 1925. (257,376.)

18,275. "Step-by-step rotary electric switches." B. C. Garman and C. Oliver. July 17th, 1925. (257,387.)

19,381. "Electric fans." H. Fairbrother (J. F. Jones). July 30th, 1925. (257,398.)

21,405. "Electric clocks." H. Gray. August 26th, 1925. (257,408.)

24,627. "Electric control systems." H. Wade (Sullivan Machinery Co.). October 2nd, 1925. (257,425.)

27,200. "Anti-vibration device for electric lamps." S. D. White and C. W. Saunders. October 29th, 1925. (257,445.)

28,209. "Bulbs for electric lamps, vacuum tubes, rectifiers, power tubes, X-ray tubes, and the like, and methods of producing same." P. Verhagen. November 9th, 1925. (257,453.)

30,153. "Electric switches." British Brass Fittings, Ltd., and G. N. Sperryn. November 30th, 1925. (257,461.)

30,273. "Electric irons." H. B. Jackson. December 1st, 1925. (257,462.)

30,329. "Means for producing a modulated electric current for systems of transmitting documents and the like." Etablissements E. Belin. December 16th, 1924. (244,741.)

30,861. "Thermal-responsive electric switch mechanisms, and protective systems employing the same." British Thomson-Houston Co., Ltd. December 16th, 1924. (244,750.)

32,755. "Electric motor controllers." W. J. Mellersh-Jackson (Allen-Bradley Co.). December 28th, 1925. (257,478.)

32,756. "Method of and means for increasing the speed of telegraphic transmission." C. Lorenz Akt. Ges. January 20th, 1925. (246,452.)

32,855. "Headlights for motor-cars and similar vehicles." N. Van der Wees. December 31st, 1924. (245,452.)

1926.

2,118. "Electric switches." W. H. Franklin. January 25th, 1926. (257,487.)

2,249. "Electric devices for actuating signals and for lighting and extinguishing the lamps of automobile vehicles." Soc. Anon. des Nouvelles inventions Mécaniques et Electriques. February 24th, 1925. (248,337.)

3,854. "Means for regulating the focus in X-ray apparatus." Dr. M. Liebermann. February 11th, 1925. (247,568.)

5,972. "Means for affixing electric light fittings to vases, ar. pots, and the like." R. P. Corbeil. March 3rd, 1926. (257,505.)

6,944. "Process for the insulation of wires and cables with coatings of both raw rubber and prepared rubber compositions." A. Ullrich. March 12th, 1925. (249,151.)

7,294. "Electric cables." Siemens-Schuckertwerke Ges. March 20th, 1925. (249,223.)

8,326. "Electric heating element." L. J. Hancock. March 26th, 1926. (257,518.)

9,428. "Alternating-current rectifiers." W. Semer Ges. and F. Kraus. April 24th, 1925. (251,257.)

9,908. "Loud speakers." P. S. Hedgeland. April 15th, 1926. (257,526.)

13,275. "Electric incandescent lamps." General Electric Co., Ltd. January 22nd, 1926. (257,543.)

13,276. "Electric luminous discharge tubes." General Electric Co., Ltd. January 28th, 1926. (257,544.)

14,328. "Wave signalling systems." Hazeltine Corporation. February 27th, 1925. (Divided application on 12,258/25.) (253,146.)